H.R. 4260—LEGISLATION TO CONTINUE THE SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM

HEARING

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY HOUSE OF REPRESENTATIVES

NINETY-NINTH CONGRESS

SECOND SESSION

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H.R. 4260—LEGISLATION TO CONTINUE THE SMALL BUSINESS INNOVATION RESEARCH [SBIR] PROGRAM

WEDNESDAY, JULY 16, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research, and Technology,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:35 a.m., in room 2325, Rayburn House Office Building, Hon. Doug Walgren (chairman of the subcommittee) presiding.

Mr. Walgren. Let me call us to order. Today the Subcommittee on Science, Research, and Technology considers H.R. 4260, legislation to continue the Small Business Innovation Research Program indefinitely. Under the existing SBIR legislation, as most of you know, the program is now scheduled to sunset October 1, 1988.

The Small Business Innovation Development Act of 1982 was designed to increase small business participation in federally funded research and development. Each Federal agency with extramural R&D programs of at least $100 million is required to set aside 1.25 percent or more of those budgets for programs geared to small business contractors.

This bill that we have under consideration today would repeal the program termination date, thereby setting in motion an indefinite extension. The bill was unanimously approved by the Committee on Small Business on June 18 and has been sequentially referred to this committee which must act on the bill by August 1.

Four years ago this program was relatively controversial; not in the long run in terms of members support, but it was a new idea that caught the attention of the small business community, certainly, and of the science community and there was a great amount of interest in the program. There were eight congressional committees involved.

Today, the program has, to a large extent, met with approval. There are certainly success stories of good experience with the program, and many who had initial reservations have been very pleased to see it work out in a positive way.

The question, of course, comes as to when it's appropriate for the Congress to make a program like this essentially locked into the law and not subject to automatic review, as would be required by a sunset provision.

The witnesses today will include congressional sponsors of the legislation, representatives from the major agencies and from the committee's jurisdiction who participate in the Small Business Innovation Research Program, along with outside witnesses from the business community and from universities.

We want to secure comments on the success of this program to date and ask for suggestions on how to assure that this program can function in the best possible way, and that the congressional oversight be appropriate in the future.

We also understand that some companies have faced some difficulties in getting from phase I to phase II in the program, and we would like to understand whether there are suggestions that should be directed toward the agencies with some focus that might give more flexibility to qualified companies to succeed under the program.

We hope to establish a record that our subcommittee and our full committee can use to consider this proposal in a timely fashion. Certainly the Science Committee has a very real interest in the disposition of the research dollars that the Federal Government is involved with.

We have, at the outset, several members who have been strong supporters of this measure from its inception, and I want to thank them for coming this morning. We certainly appreciate your contribution to our committee and, on the overall level, the force with which you have moved this provision in the past.

Let me ask if there's any opening comments that the ranking member of the minority, Congressman Boehlert, would like to make.

Mr. BOEHLERT. Mr. Chairman, I have a statement. I ask unanimous consent that it be put in the record at this point, and I welcome our colleagues here.

Mr. WALGREN. Without objection, it will be the order.

[The prepared opening statements of Mr. Boehlert and Mr. Lundine follow:]

OPENING STATEMENT

SHERWOOD BOEHLERT (R-NY)

SCIENCE, RESEARCH, AND TECHNOLOGY SUBCOMMITTEE HEARING ON

H.R. 4260 SMALL BUSINESS INNOVATIVE RESEARCH PROGRAM

MR. CHAIRMAN:

I'M PLEASED WE HAVE THIS OPPORTUNITY TO REVIEW THE SMALL BUSINESS INNOVATIVE RESEARCH (SBIR) PROGRAM BECAUSE IT'S SUCH AN IMPORTANT COMPONENT OF OUR ECONOMIC DEVELOPMENT EFFORTS.

WE'RE ALL FOND OF NOTING TWO FACTS ABOUT ECONOMIC DEVELOPMENT IN OUR SPEECHES -- FIRST, THAT SMALL BUSINESSES ARE RESPONSIBLE FOR THE BULK OF THE INNOVATION AND JOB CREATION IN OUR ECONOMY; AND SECOND, THAT TECHNOLOGICAL INNOVATION IS THE KEY TO OUR ECONOMIC FUTURE.

SBIR IS A PROGRAM THAT PUTS OUR MONEY WHERE OUR MOUTHS ARE. IT FOSTERS PRECISELY THE KIND OF CUTTING-EDGE RESEARCH AND PRIVATE SECTOR INITIATIVE THAT WE ALL AGREE IS NEEDED TO KEEP OUR ECONOMY COMPETITIVE.

THE QUESTION BEFORE US, THEN, IS NOT WHETHER TO CONTINUE THE SBIR PROGRAM, BUT HOW BEST TO ENSURE ITS CONTINUED SUCCESS.

IS A PERMANENT AUTHORIZATION MORE APPROPRIATE THAN A SUNSET PROVISION TEN YEARS DOWN THE LINE? SHOULD FUNDS BE EARMARKED FOR

ADMINISTRATIVE COSTS? IS THE LAG BETWEEN PHASE I AND PHASE II EXCESSIVE? ARE AGENCIES EXERCISING PROPER OVERSIGHT?

THESE ARE SOME OF THE QUESTIONS I HOPE OUR WITNESSES WILL ANSWER TODAY.

ALL INDICATIONS ARE THAT SBIR WORKS. IT CREATES NEW INFORMATION, NEW TECHNOLOGY AND NEW JOBS. TODAY WE'LL LEARN IF WE CAN MAKE A GOOD PROGRAM BETTER.

THANK YOU.

OPENING REMARKS
CONGRESSMAN STAN LUNDINE
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
JULY 16, 1986

Mr. Chairman, I am pleased that the Science, Research, and Technology Subcommittee has the opportunity today to hear from a number of expert witnesses on the success of the Small Business Innovation Research (SBIR) Program. I have been a strong supporter of this program and worked for the passage of the legislation creating the SBIR program during the 97th Congress.

If the United States is to assure its position as a world class competitor, we must improve our ability to translate new technology into competitive products. The SBIR program is intended to increase innovation in the private sector by requiring each federal agency with research and development programs of at least $100 million to devote 1.25 percent or more of its research and development budget to a program geared to small business contractors. The program recognizes that small businesses are a leading source of new products and technology in this country.

The legislation currently being considered in the SRT Subcommittee, H.R. 4260, would extend the SBIR program indefinitely. One of the major questions to be asked today is whether or not Congress should be required to reauthorize the program periodically, or whether the program should be made permanent. In addition, I think it is important to take this opportunity to review each agency's program, and encourage improvements if necessary.

Mr. Chairman, in April 1985, the House Task Force on Industrial Innovation and Productivity, which I chair, sponsored a briefing in conjunction with the Small Business High Technology Institute, and Price Waterhouse Partners to announce the results of a survey on the effectiveness of the SBIR program. This 1984 survey was the first organized inquiry into the progress of the SBIR program and the results were very encouraging.

According to the survey, many of the small businesses that won SBIR grants, between 1977 and 1982, for the pursuit of new technologies, expanded their sales, payroll, and financial base since receiving the awards. Almost half the projects brought products or services into being, such as laser analyzers, improved semiconductor manufacturing techniques, and membrane extraction processes. About one-quarter of these have generated commercial sales. And, federal funds were matched by twice as much private, follow-on financing.

This survey provided encouraging, initial evidence of the capacity of SBIR awards for generating not only solutions to government research needs, but commercial applications of those discoveries as well.

In my own state of New York, the program has been very successful and is growing each year. New York State has actively promoted small business participation in this program through outreach, seminars, and technical assistance to encourage the submission of SBIR proposals. New York is one of the only, if not the only, state to provide matching grants up to $50,000 to successful NYS grant recipients through the State Science and Technology Foundation. Since the program began in 1983 over 150 New York State companies received $13.8 million in SBIR awards.

In holding the hearing today, it is my hope that we will build a strong record of support for this program. It certainly has my strong support and it is my hope that legislation extending the program will be considered as expeditiously as possible.

Mr. **Walgren**. Well, then let's go directly to the first witnesses. Which would like to go first? I'll leave that up to you folks.

Mr. **Mavroules**. Mr. Chairman, with your approval, I'd like to defer to Mr. Bedell who has certain time constraints this morning.

Mr. **Walgren**. Fine. Written statements, as everyone knows, will be made part of the record without objection and please feel free to underscore the points that you'd like to make. We're really glad you're here.

STATEMENT OF HON. BERKLEY BEDELL, A MEMBER OF CONGRESS FROM THE STATE OF IOWA

Mr. **Bedell**. Thank you, Mr. Chairman, and I want to thank my colleagues. I do have to testify in regard to an issue that's of great importance to my own district here. I have a very short statement which, with your permission, I would like to go through.

I want to thank you for allowing me this opportunity. My colleagues, Congressman Mavroules and Conte, the chairman and ranking member, respectively, of the Small Business Subcommittee on Oversight will report to you the results of the subcommittee's work on this bill. Clearly the SBIR Program is a success and, clearly, we must reauthorize it.

Mr. Chairman, I'm excited about the SBIR Program. I am an original cosponsor of the bill before you today, H.R. 4260. Four years ago I was very active in enacting the original SBIR Act, and I'm very pleased with the program's results thus far, and I want to acknowledge the work that Mr. Conte did 4 years ago as well in getting this bill enacted.

It's important to remember why we began the SBIR Program. Ten years ago, the country that first put a man on the Moon realized that it was losing the innovation race. Although the United States spent large amounts on research, which added to human knowledge, that research benefited our international competitors more than it did us, because they simply moved forward and then took that research and put it into commercialization.

In the late 1970's, many studies and recommendations, including those of the 1980 White House Conference on Small Business, concluded that a primary cause for lack of innovation in the United States was the lack of research and development funding for innovative small businesses.

For various reasons, agencies simply would not fund small businesses who had new ideas and could work them most efficiently. What was needed was a program where small businesses would have the chance to show what they could do. The National Science Foundation pioneered the way with the original SBIR Program.

In fact, in 1980, the Science and Technology Subcommittee on Oversight and Investigations prepared a report that recommended that the National Science Foundation's SBIR Program should be expanded and that other agencies be required to set aside at least 1 percent of their R&D budgets for SBIR Programs. We enacted this requirement in 1982.

Many skeptics have become fans during the last 4 years. During the last year, under the leadership of Congressman Mavroules, the Small Business Subcommittee on Oversight has conducted extensive hearings where all agencies have testified that they consider the program to be a success.

It is said that imitation is the sincerest praise. During the last three summers, the Japanese Government has sent observers to the United States for a week to 10 days for the purpose of learning from our SBIR Program. The Japanese Government has written the SBA that Japan will begin a similar program within a year.

Great Britain has already begun its SBIR Program. It's called SMART, Small Firms Merit Award for Research and Technology, and it's modeled on our SBIR Program. In addition, Canada, France, and Germany have all approached the SBA to learn more about the U.S. program.

Mr. Chairman, our competitors are not far behind. We cannot afford to delay or ruin our own successful SBIR Program. I commend you for your work in this effort and I look forward to cooperating with you as we move forward.

[The prepared statement of Mr. Bedell follows:]

TESTIMONY OF HONORABLE BERKLEY BEDELL
BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY

HEARING ON H.R. 4260
SMALL BUSINESS INNOVATION RESEARCH PROGRAM

JULY 16, 1986

Thank you, Mr. Chairman, for allowing me the opportunity to testify before you today as this Subcommittee considers H.R. 4260, a bill to reauthorize the SBIR program. My colleagues, Congressmen Mavroules and Conte, the Chairman and Ranking Minority Member respectively of the Small Business Subcommittee on Oversight will report to you the results of our Subcommittee's work on this bill. Clearly, the SBIR program is a success and, clearly, we must reauthorize it.

Mr. Chairman, I am excited about the SBIR program. I am an original cosponsor of the bill before you today, H.R. 4260. Four years ago, I was very active in enacting the original SBIR Act. I am very pleased with the program's results so far.

It is important to remember why we began the SBIR program. A decade ago, the country that first put a man on the moon realized that it was losing the innovation race. Although the U.S spent large amounts on research which added to human knowledge, that research benefited our international competitors more than us.

(more)

In the late 1970's, many studies and recommendations, including those of the 1980 White House Conference on Small Business, concluded that a primary cause for the lack of innovation in the United States was the lack of research and development funding for innovative small businesses. For various reasons, agencies simply would not fund small businesses who had new ideas and could work them most efficiently. What was needed was a program where small businesses would have the chance to show what they could do.

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Mr. Chairman, our competitors are not far behind. We cannot afford to delay or ruin our own successful SBIR program.

Thank you.

Mr. WALGREN. You know, when you say our competitors are not far behind, I can't help but think of a situation when my wife and I were driving along and there were two joggers; there was a fellow who was working pretty hard and he was about 50 yards in front of a young woman who was running on the same road. This was a large country road that had about a 3 mile circumference that people run on. My wife turned to me and said that she's almost got him lapped.

So, when you say our competitors are not far behind, I sometimes wonder. Well, thank you very much for that statement. We really salute the role that you've played in this, Berkley. You've been a really good leader on it.

Let's turn to——

Mr. BEDELL. With your permission I would like to be excused and my colleagues can answer any questions you have.

Mr. WALGREN. Thank you very much for coming. Well, then we'll turn to Congressman Mavroules and then to Congressman Conte.

STATEMENT OF HON. NICHOLAS MAVROULES, A MEMBER OF CONGRESS FROM THE STATE OF MASSACHUSETTS

Mr. MAVROULES. Thank you very much, Mr. Chairman. I ask for your approval to insert into the record my complete statement. I'll try my best to capsulize it to expedite the hearing here this morning——

Mr. WALGREN. Without objection.

Mr. MAVROULES [continuing]. Realizing that we have some technical experts who will be testifying before you. I think all of us here are well aware of the history behind this landmark legislation. It awards a small percentage of Government research and development money to fund initial work by small science and technology firms on innovative ideas, ideas that could later produce products for the commercial market, or could contribute further to an agency's mission.

Four years ago, during the floor debate on this bill, many of my colleagues—and justifiably so—expressed grave concern that small businesses could not accomplish research of equal value to that of universities and larger businesses.

Therefore, as we all know, because of a sunset provision adopted by the Congress, the SBIR Program is scheduled to end as of October 1, 1988. This sunset clarified our intent to make sure the program works or the program will be terminated.

Mr. Chairman, the SBIR Program has proved that small firms can accomplish research of equal value to that of universities and large businesses. It can do so without jeopardizing the quality of Federal R&D efforts. It has also proved that the Federal Government greatly benefits from small business participation.

In May of this year, the Subcommittee on General Oversight and the Economy, which I happen to chair, held a series of hearings on H.R. 4260. The subcommittee heard testimony from representatives of the participating agencies, all of whom spoke very favorably of the SBIR Program. The agencies are excited about the high quality of the proposals they've received and about the potential benefits to be derived from these proposals.

The participating agencies, working closely together with the small R&D firms, have made the SBIR Program a huge success. I believe that a tremendous amount of credit should be given to all of the hardworking SBIR Program managers.

Of course, small business, our most innovative sector, deserves credit too, Mr. Chairman. The SBIR Program is an extremely competitive procurement program. Since its inception, there have been 25,859 proposals submitted by small high tech firms with 3,080 phase I awards and 744 phase II awards.

In money terms, we are talking about $355 million— not a lot of money when you think about the potential benefits to be derived from this small program, or when you think of the billions we spend in Federal research and development.

Another aspect of the program is the marketing of the innovative ideas being developed under SBIR. Experience has shown that actual success stories for technological inventions take many, many years to be realized. The agencies, however, have stated that the potential for commercialization of the SBIR projects they have funded is very, very promising.

During the first 4 years of the SBIR Program within the National Science Foundation, the $18.4 million in Federal funds expended were matched by private sector follow on funding of $149.5 million. This amounted to a leveraging factor of 8 to 1 of private sector money to Federal funds.

When you take into consideration, Mr. Chairman, and Mr. Boehlert, that when we talk about a UDAG grant, the average public-private ratio runs about $3.50 to $4 to 1, and this program is double that capacity. So, I think that it is a program that is working.

As more SBIR projects mature, the paybacks in terms of investments of private capital, increased employment and, hence, taxes, and enhanced productivity will be substantial.

Despite these favorable reviews, many agencies have indicated that it may be impossible without this statute to continue an SBIR-like program on their own. And because of higher competition requirements imposed by recent procurement reform legislation, it is unlikely that the gains resulting from the Small Business Innovation Development Act would continue without its reauthorization.

This brings us to the question of why we are considering its reauthorization well before the expiration date. Several agency representatives, during hearings on this bill, indicated that they must begin making their budget decisions now for 1988 and beyond. Reauthorizing the SBIR Program today would ensure continuity within the Small Business Innovation Development Act and would eliminate the possibility of disruptions in planning the procurement strategy for future R&D awards.

At a hearing on April 25, 1985, the subcommittee heard testimony from small businesses which had participated in the SBIR Program as well as from the Small Business Administration. The hearing examined the implementation of the SBIR Program since its enactment, and all those testifying spoke highly of the program and noted its potential benefits for society and the Federal Government.

My subcommittee continued its review of the act's implementation in hearings conducted in November 1985. Testimony was presented by the three agencies with statutory responsibility for SBIR oversight: the Small Business Administration, the General Accounting Office, and the Office of Science and Technology Policy. The GAO testified that all the participating agencies had made substantial efforts in successfully implementing the program.

At those hearings, Mr. Chairman, testimony from Dr. George Keyworth, then Science Adviser to the President and Director of OSTP, affirmed the value of the SBIR Program stating that it was part of what he considered to be among the more important kinds of investments that the Federal Government makes.

Commenting that his initial doubts were being dashed, Dr. Keyworth had said that the program was showing all the signs of first class augur that we have traditionally come to expect from basic research, adding that he was excited about it.

Finally, Mr. Chairman, the SBIR Program was among those recommendations that came out of the 1980 White House Small Business Conference. At the State and regional conferences which have been held in preparation for this year's White House Small Business Conference, the reauthorization of the Small Business Innovation Development Act has emerged as a No. 1 priority.

And, Mr. Chairman, as a last minute enclosure here, and I want to include this statement or this article in "The Washington Post" as of yesterday as part of the record. Let me see if I can capsulize that one particular statement that was made about Stanford R. Ovshinsky.

I'd like to draw this subcommittee's attention to an article on the front page of yesterday's "Washington Post" entitled, "An Inventor's Way With Atoms." This article highlighted the research being done by Mr. Ovshinsky of Detroit, MI, who has virtually singlehandedly created a new kind of solid state physics.

[The material mentioned above follows:]

An Inventor's Way With Atoms

New Solid-State Technology on the Horizon

By Boyce Rensberger
Washington Post Staff Writer

TROY, Mich.—Imagine a computer as thin as paper and no larger than 8½ by 11 inches but with all the power of a room-sized, Cray-class supercomputer.

Imagine a cigar-box-sized device that converts the heat of a campfire into enough electricity to run a television set.

Imagine a chalkboard that, at the push of a button, produces a paper copy of anything written on it.

Imagine a roll-up solar panel that can be unfurled on the dashboard to recharge a dead car battery in half an hour while plugged into the cigarette lighter.

Imagining such things and, more significantly, creating them, has been the full-time preoccupation for more than 30 years of Stanford R. Ovshinsky, a self-taught inventor from Detroit who has almost singlehandedly created a new kind of solid state physics.

His discoveries of certain peculiarities in the behavior of atoms, once scorned by many scientists,

See MORPHOUS, A8, Col. 1

STANFORD R. OVSHINSKY
. . . Japan accepted unorthodox ideas

AMORPHOUS, From A1

have led to the creation of materials that can produce the effects that make these devices work. All of these devices and dozens of others are either in commercial production or in development—either short-range or long-range—at Ovshinsky's company, Energy Conversion Devices Inc., based in this Detroit suburb.

Although Ovshinsky's early claims met with considerable doubt among most U.S. experts in traditional solid state physics, his unorthodox ideas found ready acceptance among the leaders of Japan's high-technology industries. Many of ECD's research, development and production programs are being carried out under various forms of collaboration with major Japanese companies such as Matsushita, Sony, Hitachi, Canon and Nippon Steel, the world's largest steel manufacturer.

Over the years Ovshinsky has made about 80 trips to Japan to negotiate contracts, to lecture before packed halls of scientists and industrialists and to meet with prime ministers and cabinet ministers. One Japanese company, reversing a trend of recent years, has asked ECD officials to reorganize its research programs to conform with ECD's work.

"We've tried for years to get American companies interested in our work, but we haven't had much luck until recently," Ovshinsky said. "Once the Japanese starting coming aboard, the Americans began to take a look."

IBM and Raytheon now have licenses to manufacture some of the ECD devices.

Ovshinsky has also won support from many of this country's top academic specialists in solid state physics. David Adler, an electrical engineer at MIT, said that in 1968 when Ovshinsky published his first paper in Physical Review Letters, the most prestigious U.S. physics journal, many scientists said, "It is unstable, it is uneconomical and it doesn't work."

Nowadays Adler said, former critics are claiming, "I invented it first."

"The most eloquent testimony to the importance of Ovshinsky's work," Adler said, "is the fact that his paper has become one of the five most cited publications in the history of Physical Review Letters."

The peculiar properties underlying Ovshinsky's inventions are those of amorphous materials, manufactured solids whose atoms are linked not in the regular latticework patterns of crystalline solids, the basis of most of today's electronic wizardry, but in irregular, disordered arrays.

Ovshinsky and the scientists he directs have learned how to select and alloy different elements into a single amorphous solid, usually in the form of a thin film, or layers of different alloys, so that they produce a variety of effects.

A 7-ounce can of solid fuel can operate this television for 105 minutes.

Some alloys make electricity when heated, others when light shines on them. Some alloys are electrical insulators that become conductors when an electric field is applied. Some function as transistors, others as the kind of switches that constitute a computer memory but without the conventional computer's annoying requirement for a continuous power supply to retain data.

Ovshinsky's success at making such materials has largely borne out his early claims that low-cost amorphous materials can do almost all the things that high-cost crystalline silicon can do and many more.

The silicon crystals in conventional transistors, computer chips and solar cells have their silicon atoms spaced at regular intervals, each linked to its neighbors by a pattern of atomic bonds that is the same for every atom. The atoms in a crystal may be arrayed as if they were the corners of millions of tiny cubes, or other regular shapes, stacked together.

An amorphous solid, by contrast, has no regular spacing of atoms. It is a jumble, each atom's bond angles reaching in different directions and distances before linking up with neighboring atoms. By planning the jumble so that atoms of various elements take up predictable three-dimensional relationships within the solid, various special effects can be achieved.

A given element can be made either crystalline or amorphous, but the conditions required to produce either state differ greatly. It is cheaper to make amorphous materials, and they have the advantage of allowing different elements to be alloyed, an impossible step with crystals.

The classic example of amorphous silicon is glass, which forms when melted silicon cools. Ovshinsky has pioneered manufacturing methods that produce solar cells and the substrates for integrated circuits and other products in large sheets almost as easily as glassmakers produce windows.

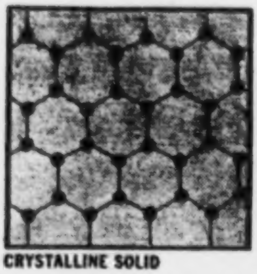
The sheets are 18 inches wide and 1,000 feet long, but could be any size. The manufacturing process deposits a microscopically thin layer of amorphous material on a thin stainless steel or plastic sheet that comes off a big roll and passes through a series of sealed boxes containing electrically charged vapors of the relevant atoms.

The atoms stick to the moving sheet, forming a film of mixed elements. If the material is to have three different layers, the sheet passes through three such boxes, each holding its own mix of atoms. At the end, the sheet emerges and is rolled up again or cut to the desired size.

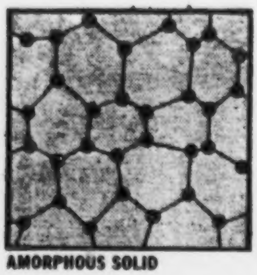
Unlike conventional solar cells, which are thick, heavy and breakable, Ovshinsky's solar panels are flexible, paper-thin sheets. The larger the sheet, the more power. ECD's current solar panels produce about 5.5 watts per square foot or about 1,100 watts per pound of panel, nearly double the goal the National Aeronautics and Space Administration set for achievement by 1995 to power a space station.

The panels now in production convert about 8 percent of the solar energy falling on them into electricity. In the laboratory an efficiency of 13 percent has been achieved, comparable to crystalline solar cells. New amorphous alloys currently in research promise 16 percent efficiency, said ECD's research director Stephen J. Hudgens, and 20 percent efficiency is considered achievable in the next five to 10 years.

Tiny pieces, less than a square



CRYSTALLINE SOLID



AMORPHOUS SOLID

inch in area, already run calculators and watches. Larger panels are powering remote irrigation pumps in Spain and being planned for previously unelectrified villages in India.

A curved solar panel that can be laminated onto a car's roof is being tested to power fans that would automatically ventilate a closed car parked in the hot summer sun. In winter, the power could keep the battery charged.

Solar cells make electricity because around the nuclei of certain atoms are electrons that are, in effect, only loosely bound. Once the electrons absorb energy from light, they become "excited" and escape.

Because electricity is simply a flow of electrons, wires attached to the cell channel the free electrons into some device, such as a light bulb or radio. The electrons flow through the device, making it work as they move along, and back through another wire into the solar cell.

The device that generates electricity from heat works much like a solar cell except that the atoms in it are chosen to produce their optimal release of excited electrons when they absorb heat energy rather than light energy.

Because solar cells do not work in the dark, ECD has also developed a new kind of rechargeable battery, using amorphous materials, that for a given size will run twice as long as existing rechargeable batteries.

While some applications of amorphous technology offer mere convenience, Ovshinsky's thin-film computer, still in the research stage, promises a virtual revolution. It could achieve the next major step in computer miniaturization and cost-reduction, cramming microscopic versions of all the components of today's supercomputers, which fill a small room, into a film no bigger than a sheet of typing paper.

Existing computer technology is essentially two-dimensional. All the thousands of transistors and memory switches in a conventional chip are arrayed over a flat surface. To grow means increasing the surface area by adding more chips. Thin-film technology makes it possible to grow simply by adding layers of amorphous components on top of each other. Several hundred layers, each containing thousands of components, would still be microscopically thin.

Layering conserves space but also permits true three-dimensionality because the hookups between components can be not only horizontal, as in existing chips, but vertical too. A component in one layer could "talk" directly to a component in a layer above, thus cutting the internal communication time that limits the speed of today's computers.

The Pentagon is interested in amorphous computers because they are free of the crystalline computer's vulnerability to radiation damage. They could, in theory, keep working in a missile's guidance system or an orbiting "Star Wars" battle station in a nuclear war.

Long before the thin-film computer arrives, ECD already has a thin-film, flat-screen display aimed at the portable computer market. It is a liquid crystal display but with such small picture elements, or pixels, that the display has much higher resolution than existing LCDs. Behind each pixel is a microscopic amorphous switch to turn it on or off as needed to form the image. ECD engineers have used the same technology to make a prototype flat-screen television display, two inches on a side.

Not all Ovshinsky's amorphous alloys find electronics applications. One turned out to combine a kind of surface slipperiness with the hardness of a diamond. It is now marketed as a coating for machine tools that extends their working life by up to 40 times.

"All the properties we find are in the atoms, if you know how to find them," said Ovshinsky, who professes an intuitive feel for what will happen if various given elements are alloyed. "I think I know the atoms like friends. I really visualize them. Sometimes I feel the atoms talk to me."

Mr. **Mavroules**. His initial claims met with considerable doubt from certain portions of the scientific and academic community, who declared that his work was unstable and uneconomical. But Ovshinsky found ready acceptance for his ideas in Japan. Only after the major Japanese corporations Sony, Hitachi, and others, had begun turning his ideas into products did U.S. firms and the academic community sit up and take notice.

Frankly, Mr. Chairman and members of the committee, this case illustrates even more why we need the SBIR Program. In fact, Ovshinsky did win an SBIR award in 1985 from the Department of the Army for an ivonic threshold switch for the protection of medical electronic equipment.

SBIR, my dear colleagues, can help the United States maintain its preeminent position in technological development.

Thank you for this opportunity, Mr. Chairman.

[The prepared statement of Mr. Mavroules follows:]

NICHOLAS MAVROULES, MASSACHUSETTS
CHAIRMAN

BERKLEY BEDELL, IOWA
NORMAN SISISKY, VIRGINIA
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TESTIMONY ON H.R. 4260 BY CONGRESSMAN NICHOLAS MAVROULES
BEFORE THE HOUSE SCIENCE & TECHNOLOGY COMMITTEE
JULY 16, 1986

I WANT TO THANK YOU FOR THIS OPPORTUNITY TO TESTIFY ON H.R. 4260, WHICH WOULD REAUTHORIZE THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT.

I THINK ALL OF US HERE ARE WELL AWARE OF THE HISTORY BEHIND THIS LANDMARK LEGISLATION WHICH AWARDS A SMALL PERCENTAGE OF GOVERNMENT RESEARCH AND DEVELOPMENT MONEY TO FUND INITIAL WORK BY SMALL SCIENCE AND TECHNOLOGY FIRMS ON INNOVATIVE IDEAS -- IDEAS THAT COULD LATER PRODUCE PRODUCTS FOR THE COMMERCIAL MARKET, OR COULD CONTRIBUTE FURTHER TO AN AGENCY'S MISSION.

FOUR YEARS AGO, DURING THE FLOOR DEBATE OF THIS BILL, MANY OF MY COLLEAGUES EXPRESSED GRAVE CONCERN THAT SMALL BUSINESSES COULD NOT ACCOMPLISH RESEARCH OF EQUAL VALUE TO THAT OF UNIVERSITIES AND LARGER BUSINESSES.

THEREFORE, A SUNSET PROVISION WAS ADOPTED BY THE CONGRESS AND THE SBIR PROGRAM IS SCHEDULED TO END AS OF OCTOBER 1, 1988. THIS SUNSET CLARIFIED OUR INTENT TO MAKE SURE THE PROGRAM WORKS, OR THE PROGRAM WILL BE TERMINATED.

IN REVIEWING THE EVIDENCE AVAILABLE TO DATE, I PERSONALLY BELIEVE THAT THE SBIR PROGRAM IS A PARTICULARLY APPROPRIATE USE OF FEDERAL FUNDS AND SHOULD BE CONTINUED.

IT HAS PROVED THAT SMALL FIRMS CAN ACCOMPLISH RESEARCH OF EQUAL VALUE TO THAT OF UNIVERSITIES AND LARGE BUSINESSES, AND CAN DO SO WITHOUT JEOPARDIZING THE QUALITY OF FEDERAL R&D EFFORTS. IT HAS ALSO PROVED THAT THE FEDERAL GOVERNMENT GREATLY BENEFITS FROM SMALL BUSINESS PARTICIPATION.

THEREFORE, I, ALONG WITH MY COLLEAGUE SILVIO CONTE AND OTHER MEMBERS OF THE SMALL BUSINESS COMMITTEE, HAVE SPONSORED H.R. 4260 TO PROVIDE CONTINUING AUTHORITY FOR THE SBIR PROGRAM BEYOND THE SUNSET DATE.

IN MAY OF THIS YEAR, THE SUBCOMMITTEE ON GENERAL OVERSIGHT AND THE ECONOMY, WHICH I CHAIR, HELD A SERIES OF HEARINGS ON H.R. 4260. THE SUBCOMMITTEE HEARD TESTIMONY FROM REPRESENTATIVES OF THE PARTICIPATING AGENCIES, ALL OF WHOM SPOKE VERY FAVORABLY OF THE SBIR PROGRAM. THE AGENCIES ARE EXCITED ABOUT THE HIGH QUALITY OF THE PROPOSALS THEY HAVE RECEIVED AND ABOUT THE POTENTIAL BENEFITS TO BE DERIVED FROM THESE PROPOSALS.

THE MODEL FOR THE PROGRAM WAS THE HIGHLY SUCCESSFUL SBIR PROGRAM ESTABLISHED BY THE NATIONAL SCIENCE FOUNDATION.

ACCORDING TO TESTIMONY PRESENTED AT OUR HEARINGS, THE NSF STRONGLY BELIEVES IN THE ROLE OF SMALL HIGH TECHNOLOGY FIRMS IN FEDERAL R&D. AS RICHARD J. GREEN, ASSISTANT DIRECTOR FOR SCIENTIFIC, TECHNOLOGICAL AND INTERNATIONAL AFFAIRS AT NSF, SAID "SMALL HIGH TECHNOLOGY FIRMS REPRESENT AN IMPORTANT NATIONAL RESOURCE TO THE UNITED STATES. THEY HAVE STRONG RESEARCH CAPABILITIES AND SERVE TO ACCELERATE TECHNOLOGICAL INNOVATION. THEY REPRESENT ONE OF THE BEST AVENUES FOR CONVERTING FUNDAMENTAL RESEARCH INTO APPLICATIONS FOR THE ECONOMIC AND SOCIAL WELL BEING OF OUR COUNTRY."

FURTHERMORE, DR. RYSZARD GAJEWSKI, SBIR PROGRAM MANAGER FOR THE DEPARTMENT OF ENERGY, NOTED THAT "EXPERIENCE HAS TAUGHT US THAT EXCELLENT SBIR PROPOSALS CAN BE ENCOURAGED IN VIRTUALLY EVERY FIELD OF DEPARTMENTAL TECHNICAL ACTIVITY."

WHILE INCREASING SMALL BUSINESS PARTICIPATION IN THE R&D PROCESS, THE SBIR PROGRAM ALSO HAS ALLOWED THE AGENCIES TO EXPLORE NEW AND RISKY IDEAS THAT WOULD NEVER HAVE BEEN CONSIDERED BEFORE. MR. HARRY W. JOHNSON, DIRECTOR OF THE SMALL BUSINESS RESEARCH OFFICE FOR NASA, STATED THAT MANY OF THE IDEAS BEING PROPOSED BY THE SMALL INNOVATIVE FIRMS HAD NOT PREVIOUSLY BEEN VOLUNTEERED TO NASA, AND "POSSIBLY WOULD NEVER HAVE BEEN OFFERED IN THE NORMAL COURSE OF EVENTS."

CLEARLY, THIS PROGRAM HAS NOT ONLY PROVIDED A NEW OPPORTUNITY FOR SMALL BUSINESSES TO PARTICIPATE IN FEDERAL R&D,

BUT THE PARTICIPATING AGENCIES HAVE ALSO BEEN ABLE TO ENHANCE THEIR ABILITY TO MEET THEIR OWN RESEARCH NEEDS.

THE PARTICIPATING AGENCIES, WORKING CLOSELY TOGETHER WITH THE SMALL R&D FIRMS, HAVE MADE THE SBIR PROGRAM A SUCCESS. I BELIEVE THAT A TREMENDOUS AMOUNT OF CREDIT SHOULD BE GIVEN TO ALL OF THE HARDWORKING SBIR PROGRAM MANAGERS.

OF COURSE, SMALL BUSINESS - OUR MOST INNOVATE SECTOR - DESERVES CREDIT TOO. THE SBIR PROGRAM IS AN EXTREMELY COMPETITIVE PROCUREMENT PROGRAM. SINCE ITS INCEPTION, THERE HAVE BEEN 25,859 PROPOSALS SUBMITTED BY SMALL HIGH TECH FIRMS, WITH 3080 PHASE I AWARDS AND 744 PHASE II AWARDS. IN MONEY TERMS, WE ARE TALKING ABOUT $355 MILLION DOLLARS -- NOT A LOT OF MONEY WHEN YOU THINK ABOUT THE POTENTIAL BENEFITS TO BE DERIVED FROM THIS SMALL PROGRAM, OR WHEN YOU THINK OF THE BILLIONS WE SPEND IN FEDERAL RESEARCH & DEVELOPMENT. FURTHERMORE, NO SINGLE GEOGRAPHICAL AREA DOMINATES; THE AWARDS HAVE GONE TO 47 STATES AND THE DISTRICT OF COLUMBIA AND COVER ALL AREAS OF SCIENCE AND TECHNOLOGY.

ANOTHER ASPECT OF THE PROGRAM IS THE MARKETING OF THE INNOVATIVE IDEAS BEING DEVELOPED UNDER SBIR. HERE, WE MUST HAVE PATIENCE. EXPERIENCE HAS SHOWN THAT ACTUAL SUCCESS STORIES FOR TECHNOLOGICAL INVENTIONS TAKE MANY MANY YEARS TO BE REALIZED. THE AGENCIES, HOWEVER, HAVE STATED THAT THE POTENTIAL FOR COMMERCIALIZATION OF THE SBIR PROJECTS THEY HAVE FUNDED IS VERY PROMISING.

HERE AGAIN WE SHOULD LOOK TO THE SUCCESSFUL NSF SBIR PROGRAM FOR OUR EXAMPLE. DURING THE FIRST FOURS YEARS OF THE SBIR PROGRAM WITHIN THE NATIONAL SCIENCE FOUNDATION, THE $18.4 MILLION IN FEDERAL FUNDS EXPENDED WERE MATCHED BY PRIVATE SECTOR FOLLOW-ON FUNDING OF $149.5 MILLION. THIS AMOUNTED TO A LEVERAGING FACTOR OF 8 TO 1 OF PRIVATE SECTOR MONEY TO FEDERAL FUNDS.

AS MORE SBIR PROJECTS MATURE, THE "PAY-BACK" IN TERMS OF INVESTMENTS OF PRIVATE CAPITAL, INCREASED EMPLOYMENT (AND HENCE TAXES) AND ENHANCED PRODUCTIVITY WILL BE SUBSTANTIAL.

UNFORTUNATELY, DESPITE THESE FAVORABLE REVIEWS, MANY AGENCIES HAVE INDICATED THAT IT MAY BE IMPOSSIBLE, WITHOUT THIS STATUTE, TO CONTINUE AN SBIR-LIKE PROGRAM ON THEIR OWN.

BECAUSE OF HIGHER COMPETITION REQUIREMENTS IMPOSED BY RECENT PROCUREMENT REFORM LEGISLATION, IT IS UNLIKELY THAT THE GAINS RESULTING FROM THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT WOULD CONTINUE WITHOUT ITS REAUTHORIZATION.

THEREFORE, IT REMAINS UP TO THE CONGRESS TO ENSURE THAT OUR FEDERAL AGENCIES CONTINUE THIS COOPERATIVE ARRANGEMENT WITH SMALL HIGH TECH FIRMS. IF WE WANT THE SBIR PROGRAM TO CONTINUE, THERE IS NO REASON THEN NOT TO REAUTHORIZE IT NOW.

THIS BRINGS US TO THE QUESTION OF WHY WE ARE CONSIDERING ITS REAUTHORIZATION WELL BEFORE THE EXPIRATION DATE. SEVERAL AGENCY

REPRESENTATIVES, DURING HEARINGS ON THIS BILL, INDICATED THAT THEY MUST BEGIN MAKING THEIR BUDGET DECISIONS NOW FOR 1988 AND BEYOND. REAUTHORIZING THE SBIR PROGRAM TODAY WOULD ENSURE CONTINUITY WITHIN THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT AND WOULD ELIMINATE THE POSSIBILITY OF DISRUPTIONS IN PLANNING THE PROCUREMENT STRATEGY FOR FUTURE R&D AWARDS.

BEFORE CLOSING, LET ME COMMENT ON PREVIOUS OVERSIGHT HEARINGS THAT MY SUBCOMMITTEE HELD ON THE SBIR PROGRAM IN THE FIRST SESSION OF THE 99TH CONGRESS.

AT A HEARING ON APRIL 25, 1985, THE SUBCOMMITTEE HEARD TESTIMONY FROM SMALL BUSINESSES WHICH HAD PARTICIPATED IN THE SBIR PROGRAM AS WELL AS FROM THE SMALL BUSINESS ADMINISTRATION. THE HEARING EXAMINED THE IMPLEMENTATION OF THE SBIR PROGRAM SINCE ITS ENACTMENT; ALL THOSE TESTIFYING SPOKE HIGHLY OF THE PROGRAM AND NOTED ITS POTENTIAL BENEFITS FOR SOCIETY AND THE FEDERAL GOVERNMENT.

MY SUBCOMMITTEE CONTINUED ITS REVIEW OF THE ACT'S IMPLEMENTATION IN HEARINGS CONDUCTED IN NOVEMBER, 1985. TESTIMONY WAS PRESENTED BY THE THREE AGENCIES WITH STATUTORY RESPONSIBILITY FOR SBIR OVERSIGHT -- THE SMALL BUSINESS ADMINISTRATION, THE GENERAL ACCOUNTING OFFICE AND THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY. THE GAO TESTIFIED THAT ALL THE PARTICIPATING AGENCIES HAD MADE SUBSTANTIAL EFFORTS IN SUCCESSFULLY IMPLEMENTING THE PROGRAM.

AT THOSE HEARINGS, TESTIMONY FROM DR. GEORGE KEYWORTH, THEN SCIENCE ADVISOR TO THE PRESIDENT AND DIRECTOR OF OSTP, AFFIRMED THE VALUE OF THE SBIR PROGRAM, STATING THAT IT WAS PART OF WHAT HE CONSIDERED TO BE "AMONG THE MORE IMPORTANT KINDS OF INVESTMENTS THAT THE FEDERAL GOVERNMENT MAKES." COMMENTING THAT HIS INITIAL DOUBTS WERE BEING DASHED, DR. KEYWORTH HAD SAID THAT THE PROGRAM WAS "SHOWING ALL THE SIGNS OF FIRST CLASS AUGUR THAT WE HAVE TRADITIONALLY COME TO EXPECT IN BASIC RESEARCH," ADDING THAT HE WAS EXCITED ABOUT IT.

FINALLY, THE SBIR PROGRAM WAS AMONG THOSE RECOMMENDATIONS THAT CAME OUT OF THE 1980 WHITE HOUSE SMALL BUSINESS CONFERENCE. AT THE STATE AND REGIONAL CONFERENCES WHICH HAVE BEEN HELD IN PREPARATION FOR THIS YEAR'S WHITE HOUSE SMALL BUSINESS CONFERENCE, THE REAUTHORIZATION OF THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT HAS EMERGED AS A NUMBER ONE PRIORITY.

INDUSTRY GROWTH, INNOVATION, PROMOTING SMALL BUSINESS DEVELOPMENT, FACILITATING THE TRANSITION TO SUSTAINING MARKETS, AND STRENGTHENING OUR NATIONAL SECURITY -- THESE ARE JUST A FEW OF THE BENEFITS WE ARE DERIVING FROM THE SBIR PROGRAM.

THANK YOU.

Mr. WALGREN. Thank you very much, Mr. Mavroules. Can you stay while we hear from Silvio?

Mr. MAVROULES. I wouldn't dare leave. [Laughter.]

Mr. WALGREN. What is it about Massachusetts——

Mr. CONTE. Mr. Chairman, I ask unanimous consent to submit my entire statement in the record.

Mr. WALGREN. The Chair recognizes Mr. Conte.

STATEMENT OF HON. SILVIO CONTE, A MEMBER OF CONGRESS FROM THE STATE OF MASSACHUSETTS

Mr. CONTE. Mr. Chairman, distinguished colleagues, it's certainly a pleasure to testify before your subcommittee here this day on this very, very important piece of legislation which I think, has a strong effect on the small business community, and that's H.R. 4260.

I want to thank you ever so much for giving me this opportunity to testify. As you know, Mr. Chairman, the purpose of this bill is to make permanent the Small Business Innovative Research Program authorized by the Small Business Development Act of 1982. H.R. 4260 would repeal section 5, the sunset provision, of Public Law 97-219.

It also clarifies the definition of the extramural budget contained in section 4 of the act. It excludes that portion of the Department of Defense budget classified as operational system development, or 6.6 from the base of funds used by DOD to compute its SBIR program levels.

On February 26, Mr. Chairman, my esteemed colleague and very good friend, Nick Mavroules, introduced H.R. 4260. He did so because he wanted to review the SBIR program to see if it was working, and, if so, he wanted to insure that there would be no gap in the implementation of the law. H.R. 4260 was referred to our Small Business Subcommittee on General Oversight. We held hearings on May 8, 13, and 15.

Testifying before us were the National Science Foundation, the Department of Agriculture, NASA, the Department of Energy, DOD, NIH, EPA, and the Department of Commerce and SBA. All attested, every witness, to the excellent quality of the SBIR proposals being received. Each witness that we had—and I have the list of the witnesses in the record here—testified on how well the program has been functioning with their respected departments and confirmed that the program has been very successful.

Unfortunately, many of the agencies testifying indicated that it may be impossible without this statute being in place to continue the SBIR program on their own. Now, you may ask the question why. It's very simple. Administrations change, bureaucracies change—not too many—policies change, but our competitors are relentless. They are very good at transforming pure research into commercial products and diffusing them throughout the world economy.

Therefore, we have a need to maintain a competitive edge in order to increase productivity, expand job opportunities, and improve our balance of trade. We also have a need for permanent, continuous outreach by Federal agencies to the American small business community in research and development. This is what SBIR does in a nutshell.

What it all means, Mr. Chairman, is that one message was resoundly clear at our subcommittee hearing, and that was that SBIR works.

A good friend at NFIB summed it up well when they stated, "As a result of $1.08 million, the Small Business Administration spends on SBIR, small firms "receive $480 million in Federal research and development." This is not a welfare program. I know my friend, Congressman Ritter, would be interested in that. It's not a Federal assistance program. Every item in SBIR solicitation is keeping with the agencies old pragmatic goals.

The awards under the SBIR are made on a very competitive basis. Abuses associated with other set-aside programs have been successfully avoided.

Mr. Chairman, those agencies and small businesses who are involved in maintaining America's technology superiority appreciate and heartily support SBIR. As you know, Mr. Chairman, I was one of the original supporters, as my good friend Mr. Bedell acknowledged here this morning. He and I were the original cosponsors of this law.

I felt then that it was a commonsense approach to tap into the innovative strengths of America's small businessmen and put them to use for the common good. Ample testimony from very noteworthy spokesmen has substantiated and validated that original feeling I had 4 years ago.

We have demonstrated, I think, the worth of this program, Mr. Chairman. But in dealing with research and development issues we have also discovered that a tremendous amount of lead time is needed before we can transform an idea into a commodity, and time is running out under the original bill.

Therefore, Mr. Chairman, I fully support this bill. I urge my distinguished colleagues to do the same and move this thing out on the floor. It shouldn't even go on a suspension. Further, I also urge them to keep this bill clean and adopt the bill as proposed by our subcommittee.

It's a good bill. It's on the mark, it's on target, it's in keeping with our original concept of 4 years ago, and I think it will go a long way in helping small business people and the research and development field.

I want to thank you for your indulgence and your patience in listening to us today.

[The prepared statement of Mr. Conte follows:]

Testimony of the
HONORABLE SILVIO O. CONTE
Hearing on H.R. 4620
July 16, 1986

Mr. Chairman, distinguished colleagues, it is a pleasure to testify on behalf of a bill that is very important to this Nation's Small Business Community - H.R. 4620. I thank you for the courtesy of extending an invitation.

As you know, Mr. Chairman, the purpose of H.R. 4260 is to make permanent the Small Business Innovation Research (SBIR) Program authorized by the Small Business Development Act of 1982 (P.L. 97-219). By statute, the SBIR program is scheduled to terminate on October 1, 1988. H.R. 4260 would repeal section 5, the "sunset provision" of P.L. 97-219. H.R. 4620 also clarifies the definition of "Extramural Budget" contained in section 4 of the Act. It excludes that portion of the Department of Defense budget classified as "Operational Systems Development" or 6.6 from the base of funds used by DOD to compute its SBIR programs levels. Just by way of brief history, PL 97-219 was signed into law on July 11, 1982 by President Reagan. The purpose of the original act is as follows.

*To stimulate technological innovation

*To use small business to meet federal research and development needs

*To foster and encourage participation by minority and disadvantaged persons in technological innovation

*To increase private sector commercialization innovations derived from federal research and development

Mr. Chairman, on February 26, 1986, my esteemed colleague and very good friend Nick Mavroules introduced H.R. 4260. He did so because he wanted to review the SBIR program to see if it was working and if so, he wanted to insure that there would be no gap in its implementation. H.R. 4260 was referred to the Small Business Subcommittee on General Oversight and the Economy which held hearings on May 8, 13 and 15. Testifying at those hearings were the following: Richard J. Green, NSF; Clare I. Harris, Department of Agriculture; Harry W. Johnson, NASA; Ryszard Gajewski, Department of Energy; Leo Young, DOD; William F. Raub, NIH; George Nesterczuk, DOT; Roger S. Cortesi, EPA; Norman Latker, Dept. of Commerce; and Richard Shane, SBA. All attested to the excellent quality of the SBIR proposals being received. Each witness also testified on how well the program has been working within their respective departments and confirmed that the program has been quite successful. Unfortunately, many of the agencies testifying indicated that it may be impossible, without this statute, to continue an SBIR program on their own.

You might ask why? Well, it is very simple. Administrations change, bureaucracies change, policies change but our competitors are relentless. They are very good at transforming pure research into commercial products and diffusing them throughout the world economy. We have a need to maintain our competitive edge in order to increase productivity, expand job opportunities, and improve our balance of trade. We also have a need for permanent, continuous outreach by all federal agencies to America's Small Business Research and Development Community. This is what SBIR does in a nutshell. Consideration of this reauthorization, now, would ensure continuity and the smooth operation of the SBIR program.

Mr. Chairman, in support of this bill I would like to quote relevant portions of some selected testimony heard by our Subcommittee. First is Mr. Richard Green of the NSF: "Small high technology firms represent an important natural resource to the U.S. They have strong research capabilities and serve to accelerate technological innovation. They represent one of the best avenues for converting fundamental research into applications for the economic and social well-being of our country. NSF is proud of its role in the original design and early experimentation which led, in part, to the development of the Small Business Innovation Development Act of 1982. ...The SBIR program provides a major opportunity for science and technology-based small firms to participate in NSF-sponsored research. It enables them to propose long term, high risk creative ideas that could only be pursued with outside support. ...The competition for award is not just high it is intense. Usually we are dollar limited in the number of awards we make. Typically, we can only fund 50 percent of the phase I proposals recommended for award. This attests to the high quality of the proposals and the capability of the high tech firms in the competition. ...During the first four years of the program in NSF, $18 million of federal funds expended were matched by private sector follow-on funding for Phase III, amounting to $150 million. This is a leveraging factor of 8 to 1 of private sector to federal funds. We are very proud of this accomplishment. ...We believe that SBIR firms may do better than other performers of Federal R&D in terms of economic value received. This due to the unique entrepreneurial and innovative capabilities of small high-tech firms which conduct R&D at lower cost. The extremely competitive nature of the program as well as the built-in incentive to utilize the government research as a base for high risk ideas and follow-on private sector investment also contribute to its effectiveness. We believe the experiment is over. The results are in -- the NSF program is a success."

Next is Mr. Harry Johnson of NASA, who after describing the increasing interest in the program and a program solicitations mailing list that is increasing at the rate of 100 names per day goes on state that: "We have come to recognize that the SBIR program has provided a new type of opportunity that was not really available to the agency, namely, the use of small firms in its R&D program, which firms have a rapid turnaround time, exceedingly high interest level, and responsiveness in doing the work. In many cases, doing things which are quite innovative that might not have been suggested by a larger firm or by other small businesses because of the lack of opportunity for addressing a large agency such as NASA." He further states that, "We have the belief, at this point, that this has been a cost effective program for us. In other words, the accomplishments in both Phase I and what we believe will be in Phase II, will have been achieved at, in many cases, for far less money than we might have had to spend on other types of contracting activities toward these same ends." He closes by discussing minority participation. "Although this was never a criterion for selection in our process, it has happened that a significant percentage of our funds -- and I believe that we found this to be 11.6 percent last year of our SBIR funds -- went to minority and disadvantage firms."

Lastly, Mr. Chairman, I would like to quote Mr. Norman Latker, Department of Commerce: "While small businesses are languishing in many parts of the world where high technology small businesses are virtually unknown, the United States is experiencing a small business explosion. We are creating hundreds of thousands of new small businesses a year. About 10% of these are high technology companies which then create 5-15 support jobs in other companies. Economic value from such support functions constitute approximately 50% of our GNP where they serve as a stabilizing flywheel. SBIR is an important part of this equation because these start-up high technology companies are most vulnerable when their discoveries are still being developed and risk capital is hard to find. There is an urgent need to maintain and enhance this progressive climate for innovation in order to cope with the massive global changes in process."

What it all means, Mr. Chairman, and these quotes are just a small sample, is that one message was resoundingly clear at our subcommittee hearings -- SBIR works. My good friends at the NFIB summed it up well when they stated

* "As a result of the $1.08 million the Small Business Administration spends on SBIR, small firms receive $480 million in federal R&D awards. This is not a federal assistance program. Every item in SBIR solicitation is in keeping with an agency's own programmatic goals. The awards under the SBIR are made on a competitive basis, and abuses that are associated with other set aside programs have been successfully avoided."

* "The SBIR has had a direct positive impact on maintaining the United States' preeminent position in technology development. The conversion of research into new products and services has increased to the benefit of both the marketplace and the government."

* "Over thirty states have developed a similar or complementary program; many foreign countries are using our SBIR program as a model."

* "It is frequently noted that the majority of all new jobs during the past decade have been generated by small firms, especially in the R&D field. Likewise, there has been a doubling of employers inmost businesses involved in the SBIR program. The payback is evident: revenue generating businesses are expanding, and the number of taxpaying

employees increases."

Mr. Chairman, those agencies and small businesses who are involved in maintaining America's technology superiority appreciate and heartily support SBIR. And, you know, Mr. Chairman, I was one of the original supporters of this program. I felt then that it was a common-sense approach to tapping the innovative strengths of America's small businesses and putting it to use for the common good. Ample testimony from very noteworthy spokespersons has substained and validated my original feelings.

We have demonstrated its worth, Mr. Chairman, but in dealing with research and development issues we have also discovered that a tremendous amount of lead time is needed before we can transform an idea into a commodity, and time is running out under the original bill. Therefore, Mr. Chairman, I fully support this bill and urge my distinguished colleagues to do the same. Further, I also urge them to keep this clean and adopt the bill as proposed. It's a good bill, it's on the mark, and it's in keeping with our original concept. Thank you, Mr. Chairman.

Mr. **Walgren**. Well, we appreciate your coming, obviously, and your committee has had such a direct interest in this that your views are magnified many times. I just have one thought and then I'd like to ask my colleagues whether they would like to pursue anything.

I think it is common sense, and I think you can have a pretty instinctive reaction to this and not be off the mark. The reservation I'd have would be that if we are looking at a program that was a 4-year phase-in, and if we are only getting into phase II, is it the best course to remove the sunset provision completely?

There are those that felt when I first came to Congress that we ought to sunset everything in the Government and that the thing would work better because of that.

Any reactions to that thought?

Mr. **Mavroules**. Let me respond to that, Mr. Chairman. I, too, had some of the same concerns you did and I'm a great sunset advocate, by the way. I had the same ideas when I first came here. But the more testimony that we had taken from experts in the field, we found that we didn't have any opposition, whatever, in all the testimony. We called all parties together. We had about five or six hearings. We even had a hearing in Boston. So the program is working and some people have changed their views on the program, and now are very positive about the program.

The difficulty that we have, and the businesses have out there, is that when you're inventing—and some of you have some technical background; I know Mr. Ritter does—sometimes it takes 6, 8, 9, 10 years. The uncertainty for a business to get involved in legislation with a sunset makes it very difficult for that business to continue.

In other words, we're sunsetting now the present law in 1988. People are talking about phase II and phase III in the future. They don't know how to plan for that beyond 1988. So therefore, there is a huge question mark: Where do they go and how do they plan?

I think the proper direction, after taking all of the testimony—and you're going to hear technical testimony later on—is that we get rid of the sunset and give this an opportunity to work without any constraints. If, in the future, we find it's getting out of hand, we can always address the issue. But I do feel very strongly that we've got to take that constraint off and give it a chance to work, particularly today when we're fighting for that technological edge. We've got to give our people an opportunity without a huge question mark 3 years down the road.

Mr. **Conte**. I agree with what Nick says. You've got to have that lead time, and I mentioned that in my testimony. If you had a sunset provision, there would be that great question of uncertainty, plus the fact that you could see what's happening to the Congress here today. We're almost paralyzed. You know, we need a clean air act, we need a water bill, we need a superfund bill. We're going to have to meet Gramm-Rudman-Hollings targets and we're not meeting them. We're almost paralyzed and this could get caught in that spider web, too.

So, yes, when we first—Bedell and I first nurtured this bill, we had a lot of opposition, and we had a lot of opposition from different committees. NIH fought us, quite a few of the agencies fought us. But it was just beautiful up there. Nick holding hearings and not getting one person—I don't think we had one—opposed to it. All had applause for it, and said what a great thing it was and how well it was working, and that we should extend it.

And I agree with you. I was for sunset. I've testified before committees. I thought that maybe it was an idea whose time had come. But now, as I sit here, and I see legislation—good legislation can't come out on the floor of the House—getting bogged down, I'm really scared. Here's a piece of legislation that has no opposition—it's working. Don't tie it down with sunset.

Mr. WALGREN. Thank you very much. Mr. Boehlert?

Mr. BOEHLERT. As always, Mr. Conte, you're eloquent and I want to compliment you and your departed colleague, Mr. Bedell, for the outstanding job you did four years ago. You had some——

Mr. WALGREN. Departed?

Mr. BOEHLERT. Well, departed from this room. [Laughter.]

This program is working, as you point out so well. If it was up to me, we'd report it out immediately. As a matter of fact, part of the problem in getting legislation bogged down is that we have so darn many committees fighting for jurisdiction. I think the Small Business Committee did an excellent job initially. You've monitored the program well. It is working as intended. And I'd like to get on with the job.

I'd like to commend you, Mr. Mavroules, and our distinguished colleague, Mr. Bedell, who is now elsewhere.

Mr. MAVROULES. Thank you, Sherwood.

Mr. CONTE. I say—you're absolutely right. I say that if Moses were alive today and he was trying to write the Ten Commandments, he'd never get there because he'd be walking up to the mountain, and somebody would be grabbing him and saying, wait a minute, you're in my jurisdiction.

Mr. BOEHLERT. Thank you very much.

Mr. WALGREN. The Chair recognizes Mr. Ritter.

Mr. RITTER. Thank you, Mr. Chairman. That comment by Silvio reminds me of the old biblical story of the parting of the Red Sea. It couldn't happen today with such dispatch. The Israelites probably never would have escaped from Egypt because they would have needed an environmental impact statement first.

I do appreciate the testimony of my distinguished colleagues, and two more thoughtful Members of the House of Representatives would be hard to find. I am in agreement with them on this particular issue. As you know, there is sequential referral of this legislation, and I happen to serve on another one of the committees that will receive this legislation, in the Energy and Commerce Committee.

In the Energy and Commerce Committee, there have been questions raised about the applicability of SBIR to the National Institutes of Health. And, of course, we don't have jurisdiction over the NIH research here, but we do in the other committee.

I just wondered if, in predicting some discussion on that issue, if you had any comments you'd like to share with us, and also maybe perhaps comment on the idea of a 10-year sunset provision. How would you view that, because that seems to be a topic of discussion as well?

Mr. **Mavroules**. I will not respond to the first part of your question, Mr. Ritter. I know you're going to have testimony coming before you after we leave. It's a judgment on the part of the Energy and Commerce Committee.

I just want to assure you and, by the way, I want to assure the chairman and Mr. Boehlert, that I'm going to be talking with the chairman of your full committee to see if we can expedite this process because it's very important that we act on this expeditiously.

The second part of your question referred to what—what was the second part of your question?

Mr. **Ritter**. The 10-year sunset provision, the potential for a 10-year——

Mr. **Mavroules**. As you well know, when you're in research and development and you're coming up with new projects in technology, I think for one to say that it will take 3 years or 4 years to develop a particular project is misleading. At times it could be 6 years or 9 years or 10 years, and in some areas, by the way, it could take 20 years. Let there be no doubt about that.

I feel very strongly about this, by the way. I could say to you, let's make it 10 years and it's a pretty good buy. And maybe it can work in 10 years, I don't know. But I wonder why we have to put any limit on it at all. I think it would be far more effective, and I think the process would work a hell of a lot better, if we didn't put any limit on it at all. If the program is not working 3 or 4 years down the road, or if we feel, as a Congress, that we're throwing money out the window, we can address that issue once again.

The main point that we want to make this morning is that the program is working. The public/private ratio is running about 8 to 1 in the scientific areas, and we shouldn't just turn our head on that. That's extremely important when you compare that with other programs.

We talk about the qualitative technological edge that we want to achieve as a nation, and I think we're doing that, and this is the way to go. I'm looking down the road 10, 20 years from now. Maybe none of us will be here, I don't know. But I think this is the way to go. If you're going to put any restrictions on, I just don't think it helps.

I don't see the need for it, to be honest with you. We can readdress the issue later on.

Mr. **Conte**. I agree, 10 is better than 5. No sunset is better than 10. However—and on the question of NIH, I happen to be a ranking minority Member on handling that budget with Bill Natcher. We just reported out, before the July recess, a record number, the highest appropriations for NIH in the history of this country; in the billions. I remember when Bill and I first got on that committee. I think we appropriated $70 million for NIH, and now we're up to $5 billion, over $5 billion.

Mr. **Ritter**. It sounds like ancient history.

Mr. **Conte**. It sounds like I've been around here a long time, and some people think too long. But I didn't gather—and I'm sure that Weingarten or anybody else would come up to my office if they were experiencing any problems. And they testified before a committee. I just asked counsel for the testimony. They testified in favor of continuing the program.

So, I don't see any difficulties and we'll be ready to go before your committee and make our presentation to the cardinal. [Laughter.]

Mr. RITTER. That's good when you have the pope coming to testify before the cardinal.

Mr. WALGREN. Thank you, Mr. Ritter. On behalf of our committee, thank you very much for your time. You're good to spend it with us and we'll see you soon.

Mr. CONTE. Thank you.

Mr. MAVROULES. Thank you, Mr. Chairman.

Mr. WALGREN. The next witness is from the Government Accounting Office, Dr. Mark Nadel. Welcome to the committee. Your written statement will be incorporated in the record in its complete form, so you needn't feel bound by it. Please feel free to emphasize those points that you think would be most significant and that you'd like to underscore.

So, please proceed.

STATEMENT OF MARK V. NADEL, GROUP DIRECTOR, RESOURCES, COMMUNITY AND ECONOMIC DEVELOPMENT DIVISION, U.S. GENERAL ACCOUNTING OFFICE

Mr. NADEL. Thank you, Mr. Chairman. I'd like to read a summary of our statement, the whole of which has been entered into the record. With me today are Mr. Woodliff Jenkins and Miss Janet Mascia, who are also responsible for our work in this area.

We are pleased to be here today to discuss the implementation of the Small Business Innovation Development Act of 1982. Our report on this subject, which was issued in October 1985, reviews the extent to which agencies established, funded, and provided accurate information on the activities required by the law. It also assesses program coordination, monitoring and congressional reporting activities of the Small Business Administration and the Office of Science and Technology Policy.

Generally we found that agencies have complied with the act's funding requirements, but most did not technically adhere to the act's reporting requirements. In the area of program oversight and monitoring we found that the Small Business Administration has actively pursued and fulfilled its responsibilities, while the Office of Science and Technology Policy had elected to limit its efforts.

In summarizing our statement, I would like to cover three areas. First, SBIR programs; second, non-SBIR goals; and, third, program oversight.

First, regarding SBIR programs, as you know, the act requires any Federal agency that spends more than $100 million annually on extramural research to establish a Small Business Innovation Research, or SBIR, program. Agencies must spend a percentage, now 1.25 percent for most agencies, of their extramural funds on SBIR programs, and must report program and funding data annually to both SBA and OSTP.

The program is in three phases. In phase 1 it's basically seed money. Small firms compete for awards of $50,000 or less to demonstrate the feasibility of a project. The agency selects the best completed phase 1 projects for phase II, during which the agency awards additional funds of up to $500,000 to carry out the principal R&D efforts.

In the third phase the firms are expected to commercialize the new technologies through the private sector or non-SBIR Government procurement.

Currently, the 11 agencies meeting the extramural funding criterion have SBIR programs. Together, through fiscal year 1985, the SBIR agencies received over 26,000 proposed projects, made almost 3,900 SBIR awards, totaling $355 million.

In regard to compliance by the agencies with the SBIR funding percentages, we found that most agencies did, in fact, either meet or come very close to their required percentages. But two concerns were found in this area. First, in reporting funding data, estimated rather than actual data were submitted.

We recommended that the Small Business Administration revise its reporting deadlines to facilitate agency reporting of actual obligations, and this has occurred.

Second, a dispute exists between the Small Business Administration and the Department of Defense over the size of the Department's extramural research budget. The difference was about $2 billion in 1984, which translates into $11 million in SBIR funding. This discrepancy occurs because DOD uses different definitions in reporting budget data to the Small Business Administration, than to the National Science Foundation and OMB, and excludes the operational systems development category of its R&D appropriation, category 6.6.

We recommended that DOD report consistent figures to all agencies, and a subsequent legal opinion by the Comptroller General held that the disputed amount was R&D as defined by the Small Business Innovation Development Act. But the opinion also suggested that Congress may wish to consider exempting these 6.6 funds from SBIR because of several practical difficulties raised by DOD. We note that H.R. 4260 would exempt these funds.

Moving now to the second area, non-SBIR goals, the act requires that all agencies with total research budgets exceeding $20 million set goals for awarding research funds to small businesses. These goals must not be less than the percentage of an agency's total research budget that went to small business the preceding year.

We cannot say at this time whether the 18 agencies required to have non-SBIR goals actually met that requirement because the data reported to SBA was either incomplete or inappropriate. However, we have recommended that agencies take several steps to rectify the situation and to set meaningful goals.

With regard to both goals and the SBIR program there is an ambiguity in the requirement for participation that we would like to point out. It is not clear whether agencies whose research budgets have met the $20 million criterion must continue to set goals if, in a later year, they drop below that $20 million in total research. A similar ambiguity exists regarding participation in the SBIR program itself if an agency drops below the $100 million extramural research trigger in a later year. And this appears to have happened in the Department of Interior.

We recommend that Congress make clear whether these are annual or one time criteria.

Regarding the third area, program oversight, the Small Business Administration and the Office of Science and Technology Policy were assigned similar responsibilities for monitoring and reporting to Congress on the implementation of SBIR programs.

We found that SBA successfully made extensive efforts to fulfill its responsibilities under the act. They issued policy directives and made extensive efforts to stimulate small business participation, to coordinate agency solicitations, and to oversee and report on the implementation of the program.

In contrast, although the Office of Science and Technology Policy has complied with statutory requirements, it purposely limited its efforts in overseeing the program. OSTP said that it minimized its efforts for two reasons. First, to avoid duplication of the Small Business Administration's monitoring efforts and, second, because it believes that the required duties are inappropriate and impractical given its mission and limited staff resources.

The reports of the authorizing committees, however, show that Congress expected OSTP to concentrate on assessing research quality while SBA would protect the interests of small business. In this way, the roles of the two agencies would complement each other.

We recommended, therefore, that OSTP monitor research quality using, as the act requires, the Federal Coordinating Council for Science, Engineering and Research to do so.

This concludes our statement, Mr. Chairman, and we'll be glad to answer any questions you may have.

[The prepared statement of Mr. Nadel follows:]

United States General Accounting Office
Washington, D.C. 20548

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STATEMENT OF

MARK V. NADEL, GROUP DIRECTOR

RESOURCES, COMMUNITY, AND ECONOMIC

DEVELOPMENT DIVISION

BEFORE THE

SUBCOMMITTEE ON SCIENCE,

RESEARCH AND TECHNOLOGY

OF THE

HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

ON

IMPLEMENTATION OF THE SMALL BUSINESS

INNOVATION DEVELOPMENT ACT OF 1982

Mr. Chairman and Members of the Subcommittee:

We are pleased to be here today at your request to discuss our October 25, 1985, report on the implementation of the Small Business Innovation Development Act of 1982 (GAO/RCED-86-13). Our report, which covers fiscal years 1983 and 1984, assesses the extent to which agencies established, funded, and provided accurate information on those activities required by the law. It also assesses program coordination, monitoring, and congressional reporting activities of the Small Business Administration (SBA) and the Office of Science and Technology Policy (OSTP). We also are providing the limited amount of update information which we have at this time.

We found that agencies, for the most part, complied with the act's funding requirements, but that most did not fully adhere to the act's reporting requirements. In the area of program oversight and monitoring, we found that SBA actively pursued and fulfilled its responsibilities, while OSTP elected to limit its efforts.

I will briefly review some of the key provisions of the act, along with our findings.

SBIR PROGRAMS

The act requires each federal agency that spends more than $100 million annually on extramural research to establish a small business innovation research program. These programs, commonly called SBIR programs, are open only to small businesses. Agencies must spend specified percentages (up to 1.25 percent) of their extramural funds on SBIR programs and must report program and funding data annually to both SBA and OSTP.

Each agency participating in the SBIR program must follow a three-phase funding process. Each year the agency solicits project proposals and selects a limited number for Phase I funding. During this first phase, the agency awards each company limited funding (usually $50,000 or less) over a short time (normally 6 months or less) to demonstrate the feasibility of a proposed project. The agency selects the best completed Phase I projects for Phase II, during which the agency awards additional funds (usually $500,000 or less) over a 1 to 2-year period to carry out the principal research or R&D efforts. In the third phase, firms are expected to commercialize their new technologies through non-federal sources or, if appropriate, through traditional (non-SBIR) federal agency procurement programs. No SBIR funds may be used during the third phase.

Currently, 11 agencies meet the extramural funding criterion and have SBIR programs. Through fiscal year 1985, SBIR agencies had received over 26,000 proposed projects and made almost 3,900 SBIR awards totaling $355 million.

Technically, compliance with the act's SBIR funding percentages must be determined using actual obligations. Most agencies, however, reported extramural figures to SBA reflecting estimated obligations or appropriations. This was done, by and large, because estimations were more readily available than actual obligations when the agencies had to report to SBA in late December. Most agencies said that it would be difficult to report the proper figures because doing so would require extra work for budget personnel who are already busy at that time of year preparing final budget submissions to the Office of Management and Budget. Most agencies said, however, that they could report actual extramural obligations by early March, which is the normal date for reporting these and other research funding data to the National Science Foundation (NSF).

In our report we therefore recommended that SBA revise its reporting deadline to March, and that agencies report actual obligations. Most of the affected agencies agreed with these recommendations and SBA has since revised its reporting deadline to March 15. Using the actual obligation figures that agencies reported to NSF, we determined that most agencies either met or came very close to meeting their required SBIR percentages.

There remains, however, an important outstanding dispute between SBA and the Department of Defense regarding the amount of DOD's extramural research budget. SBA considered the budget to be $17.9 billion for fiscal year 1984, while DOD contended that the proper figure was about $2 billion less. This translated into a difference of almost $11 million in the required SBIR funding. The discrepancy occurred because DOD inconsistently classifies the Operational Systems Development category of its research appropriations (category 6.6) when reporting research and development budget data to SBA, NSF, and OMB. This category funds research for needed changes to weapon systems that are already operational or in production. DOD excludes the category when reporting its extramural R&D budget to SBA, but includes this same category when reporting its R&D expenditures to NSF and to OMB. SBA uses the figures reported to NSF to estimate agencies' extramural research funding.

DOD originally excluded the 6.6 category when reporting to SBA because it contended that activities in the category do not conform to the act's definition of R&D. SBA maintained that NSF's definition of R&D is the same as that in the act. In our report, we agreed that the definitions are the same and recommended that DOD report consistent figures.

Subsequently, in response to a request from the House Small Business Committee, the Comptroller General issued a legal opinion (B-209790, Feb. 21, 1986) which concluded that DOD activities conducted with 6.6 funds are within the definition of R&D specified in the Small Business Innovation Development Act. Thus, the extramural portion of such funds should be reported to SBA and included in calculating DOD's mandatory SBIR funding amount.

DOD, however, has raised some practical difficulties to including 6.6 funds in the SBIR funding base--in particular the fact that these funds are largely committed to specific weapons systems contractors and thus offer no real opportunity for small business competition.

DOD's current position is that it still will not include 6.6 funds when reporting to SBA but will explain which funds have been excluded and the basis for that exclusion. We note that H.R. 4260 would exempt the 6.6 funds.

NON SBIR GOALS

Because Congress intended that the SBIR program be a net addition to the agencies' existing small business research awards, all agencies with total research budgets exceeding $20 million are required to set goals for awarding research funds to small businesses. These goals must at least equal the percentage of an agency's total research budget that went to small businesses the preceding year; SBIR awards cannot be counted toward meeting an agency's non-SBIR goals.

Most of the 18 agencies required to have non-SBIR goals collected and reported fiscal year 1983 and 1984 goals data to SBA. However, in both fiscal years most agencies did not provide SBA with all the data needed to properly determine goal attainment. For example, in fiscal year 1983 some agencies reported no data at all, while others reported extramural rather than total research dollars as a base for their goals. While the quality of data improved in fiscal year 1984, the amount of total research dollars (the legislatively required basis for computing goals) that agencies reported to SBA differed from that reported in the President's budget. One reason for the inconsistency is that agencies do not normally make their budget figures final until after SBA's December reporting deadline.

We could not determine whether the agencies actually met their goals because the data reported to SBA were either inconsistent or inappropriate as a basis for judging goal attainment. We did, however, recommend that certain actions be taken in order to make goals meaningful targets. In particular, we recommended that agencies set their goals at the beginning of the fiscal year and make those goals known to program officials responsible for awarding external R&D funds. The agencies should also collect the information needed to meet SBA's reporting requirements and to determine whether they have achieved their goals by the end of the year. Fewer than half the agencies followed all of these practices. While we realize that following our recommended practices will not guarantee goals achievement, we believe that they are preferable to leaving goals achievement essentially to chance by treating it as an after-the-fact reporting exercise, as many agencies did. As we also recommended, SBA changed its deadline so that agencies could more easily report non-SBIR goals data.

AMBIGUOUS PARTICIPATION CRITERIA

The criteria for required activities is ambiguous with regard to both the goal setting requirement and the SBIR program. It is not clear whether agencies whose research budgets had met the $20 million criterion must continue to set goals if they drop below $20 million in later years. This situation occurred at the Department of Housing and Urban Development, which met the criterion requiring goal setting in fiscal year 1983 but not in fiscal year 1984. As a result, HUD did not submit a 1984 annual report to SBA. Regarding the goals requirement, we recommended that when the act is considered for reauthorization, the Congress make it clear that the $20 million criterion should be applied annually to identify those agencies that must establish goals.

After our report, the Department of the Interior dropped its SBIR program when its extramural research budget apparently fell below the required $100 million minimum. Accordingly, Congress may want to make it clear whether the criterion for participation in the SBIR program is an annual one.

PROGRAM OVERSIGHT

The act assigns the Small Business Administration and the Office of Science and Technology Policy similar responsibilities for monitoring and reporting to Congress on the implementation of SBIR programs.

We found that SBA made extensive efforts to fulfill its responsibilities under the act. Specifically, we found that, as required, SBA issued policy directives for the conduct of the SBIR programs that complied with the act. Additionally, SBA made extensive efforts to stimulate small business participation, to coordinate agency solicitations, and to oversee and report on program implementation.

The act requires the Office of Science and Technology Policy--in consultation with an interagency group, the Federal Coordinating Council for Science, Engineering and Research--to independently survey, monitor, and report to the Congress on the implementation and operation of the SBIR programs. Although OSTP has complied with the requirements for monitoring, surveying and reporting to Congress, it purposely limited its activity and has not assessed the quality of the research as envisioned in the reports of the House and Senate Small Business Committees. Thus, the Director of OSTP has not utilized the Federal Coordinating Council for SBIR oversight and OSTP staff have conducted a very limited review of the program. OSTP has submitted annual reports to the Congress for fiscal years 1983, 1984, and 1985. The reports' conclusion that the SBIR agencies were all making "good faith" efforts to accomplish the purposes of the act were based for the most part on review of the agencies' annual reports to SBA and OSTP.

OSTP limited its activity for two reasons--a belief that the required duties are inappropriate and impractical given OSTP's mission and its limited staff resources, and a desire to avoid duplication of what OSTP believes to be adequate monitoring by SBA. Additionally, in its fiscal year 1984 report, OSTP maintained that the quality of research is assured through the competitive review procedures normally utilized by the agencies. Therefore, OSTP holds that further evaluation by OSTP is not necessary any more than it would be for other research programs of the various agencies. The reports of the authorizing committees, however, indicate that the Congress expected OSTP to concentrate on assessing research quality, while SBA would protect the interests of small businesses so that the monitoring roles of the two agencies would complement rather than duplicate each other. Therefore, in our report we recommended that OSTP monitor research quality, utilizing the Federal Coordinating Council for Science, Engineering and Research to do so.

GAO ROLE

The act requires a GAO report on the program by July 1987. Currently, GAO has underway a study of the SBIR proposal review and award process, with a report scheduled for March 1987. Also, we have sent out a questionnaire to a large sample of SBIR award recipients to obtain information on the characteristics of firms receiving awards and their experience with the program. This information, together with the views of the agencies on the impact of SBIR on their overall research programs is scheduled to be presented in our summary report, which is scheduled for June 1987.

This concludes my statement, Mr. Chairman. I will be happy to respond to any questions.

Mr. **Walgren**. All right, thank you. It's a little frustrating for us to see the difficulty that you have with getting the information, and it's a little hard to hear the arguments from agencies that might not want to do this that have not been specific in meeting their reporting requirements.

Mr. **Nadel**. Well, we found that the report covered fiscal years 1983 and 1984, and we found that the situation did improve in 1984. There were some difficulties, probably due to confusion, early on. The reporting situation will, most likely, improve because the SBA has moved, as we recommended, its reporting deadline from, I believe it was, January to March. And that ought to enable the agencies to report actual obligations instead of estimated or instead of appropriations.

Mr. **Walgren**. What indications are there that the agencies were spending money in this dimension to begin with? As I understand it, the moneys intended by this program are to be over and above, is that right, what had been previously spent?

Mr. **Nadel**. That is correct.

Mr. **Walgren**. How sure are we that the moneys that are committed under this program in fact are over and above what was previously spent?

Ms. **Mascia**. The fact that agencies need to spend over and above what was previously spent is for the program dealing with non-SBIR goals. And, as with the SBIR program, these agencies are required to submit an annual report on what they're spending in that area as well as SBA.

Mr. **Walgren**. You have to make it a little more clear to me. The program is for—the non-SBIR goals, goals being not the amount but purpose in this instance?

Ms. **Mascia**. The goals are the percentage, the percentage set by the agency, and that percentage has to be at least equal to the percentage of money that went to small businesses of their research budget the preceeding year. The goal is that percentage number.

Mr. **Nadel**. The goals requirement was put in to ensure that the agencies would, in fact, be spending more and would not simply shift resources to SBIR. They wouldn't just be robbing Peter to pay Paul.

What we pointed out in our report is that we were unable to say whether that purpose had been met because the data reported to SBA under the goals requirement was inconsistent or inappropriate. So we really are unable to say whether in fact the agencies are spending more.

At a later time when we do an update and the data improves, we should be able to come to a conclusion on that, Mr. Chairman.

Mr. **Walgren**. Do you have any view of whether or not these kinds of investments would be continued without this kind of legislation?

Mr. **Nadel**. We don't have any definitive information. We are in the process of getting a questionnaire back from the small business recipients. We sent out a questionnaire to 1,400 project award winners, and among the things we asked them were whether they tried to get other sources of funding and what sources of funding they have for phase III. That questionnaire just went out recently and we're still in the process of getting it back in. So we don't have an answer to that yet.

Mr. **Walgren**. Do you have any view of the difficulties of going from phase I to phase II? Now, as I understand it, you're putting out your whole allotment or your whole required allotment in seed money for evaluation in phase I, and then you are asking to take that—an equal amount of money in the following year, but enlarge the awards.

Now, how are companies getting through from that first portion to secure greater amounts of money from the same amount or the same sized pot in the second phase?

Mr. **Nadel**. Well, there are many fewer phase II award winners. The number of phase II awards is about a little over 26 percent of the number of phase I awards. So it is a winnowing process, and our understanding is that it was meant to be a winnowing process.

We have heard some concerns from small business, and just listening to other witnesses from the small business community, that there is a time lag between phase I and phase II. On the other hand—and again, in our questionnaire, we are asking that question; what are the problems of the program, and specifically whether that gap is a problem.

On the other hand, we have been advised by agency officials that we've talked to that a certain gap is necessary because the purpose, the design of the program, was that phase II not be an automatic follow on; that there be an opportunity for the agency to evaluate whether, in fact, the promise of the project awarded in phase I was realized before going on. It is not supposed to be a noncompetitive renewal.

Mr. **Walgren**. Is there the potential that if they award phase II funds they will essentially use up all the money that they have available in that subsequent year? So as the program goes on, in the first year you'll see 10 phase I, no phase II; in the second year you might see 3 phase II, no phase I.

How can we keep the phase I basket full if they start to use up their funds on phase II?

Mr. **Nadel**. We don't have figures for all the agencies, but it is a continuous process. It's not that they just give phase I in the first couple of years of the program and then switch to phase II. There are still phase I, new phase I, awards being made.

Mr. **Walgren**. If they choose to make them.

Mr. **Jenkins**. Mr. Chairman, I'd like to also point out that the pot of money increases each year due to the increasing percentage of the extramural budget that has to be committed to the program. So there is a large amount of money available from year to year up through fiscal year 1987, I believe, when it maxes out. So the agencies have a larger pot of money to work with each year, and they have to make decisions as to how many phase I's and phase II's they can fund with the amount of money they have to work with that year.

Mr. **Walgren**. Thank you very much. Mr. Boehlert?

Mr. **Boehlert**. Mr. Nadel, is there a mechanism in place so that we can avoid duplication? Is there any way to measure that?

Mr. **Nadel**. Do you mean a duplication of research projects?

Mr. Boehlert. Yes, between different agencies. Is there any tracking system so that one agency knows what the other agency is doing?

Mr. Nadel. Mr. Boehlert, that's a perennial problem not only in SBIR. The Small Business Administration does track the program. But given the highly technical nature of award titles, for example, it would not be feasible to just scan a list of titles and say, ah, this is the same as that. There's a practical difficulty——

Mr. Boehlert. Did you uncover any examples of duplication of funding to a given company?

Mr. Nadel. Yes. Companies do get multiple awards, but not necessarily or presumably not for the same project. We did not uncover any examples, but we did not look for instances of that kind of problem.

Mr. Boehlert. Do you think the program has suffered at all from the lack of OSTP oversight?

Mr. Nadel. I just don't know. We have no information that it has suffered, but I don't want to give a categorical answer that there was no effect. Suffice it to say that we didn't find any problems and certainly none of the agencies complained to us that they weren't getting enough oversight. [Laughter.]

Mr. Boehlert. That's not surprising. Is there any way that you've been able to evaluate the effectiveness of the program?

Mr. Nadel. Well, we are assessing the program. As you know, the act requires that we report on the implementation of the program, the nature of the research, and the agency head's judgment of the impact of the program on their own research program. That's very specific language.

In our summary report we will be getting the opinions of agency heads and, more than that, we will let the agencies know that we would like to get the basis for the judgments of the agencies on the efficacy of the program. It's not enough to just say that the program is working well, sincerely yours. We'd like to know what the agencies have done to monitor.

In terms of an overall evaluation, we discussed doing that, but have decided that it's extraordinarily difficult. It's really almost impossible, if not impossible, to say what the program is doing that would not otherwise have occurred because of changes in the economy and a whole list of imponderables. But we are doing some assessing. We have recently issued a report with profiles of, I believe, 16 firms. So we are doing some assessment and getting perceptions of program success.

Mr. Boehlert. One more thing. Do you have any feel for whether the research that has been conducted under this program would have been conducted without the program?

Mr. Nadel. We don't know. We don't know at all. The firms we've talked to have pointed out difficulties they have had in getting venture funding or the reluctance they have to go to venture capitalists, have just reported general difficulties.

Mr. Boehlert. That's a universal problem, isn't it, the lack of venture capital?

Mr. Nadel. I don't know. I just—there's not enough information to comment on that. But we certainly don't have any definitive answer as to whether this research would have gone on in the absence of the program, and that is, as I said, the fundamental problem in evaluating this program in a scientific way.

Mr. BOEHLERT. Thank you very much for an excellent testimony.

Mr. LUNDINE [acting chairman]. Thank you very much. We appreciate your contribution to the subcommittee's evaluation.

We will now hear from a panel of people; Dr. Donald Senich of the National Science Foundation; James Decker of the Office of Energy Research, Department of Energy; and Harry Johnson, Director of Small Business Innovation Research Program at NASA.

Dr. Senich, I think we'll start with you, please. I think we have written testimony from all of you, and it will be included in the record in its entirety. If you can summarize, we would appreciate it.

STATEMENT OF DR. DONALD SENICH, DIRECTOR, DIVISION OF INDUSTRIAL SCIENCE AND TECHNOLOGY INNOVATION, NATIONAL SCIENCE FOUNDATION

Dr. SENICH. Thank you, Mr. Chairman. It's a pleasure to have the opportunity to present our views on the implementation of the Small Business Innovation Research Program at the National Science Foundation.

I asked Mr. Roland Tibbetts to join me today primarily because Mr. Tibbetts and Mr. Greene, in 1977, were the individuals who developed the concept of SBIR at the National Science Foundation—implemented it originally in 1977 and then nurtured this program through the period of time from 1977 to today. And so, Mr. Tibbetts can provide you sort of an institutional memory that perhaps many of us do not have, and he'll be available for any questions you might have.

We believe that the small high technology firms represent an important national resource. Not only are they an important source of innovation and job creation, but they represent an excellent mechanism for converting research and technology into products and services in the marketplace. We, at the Science Foundation, are proud of the original design and early experimental role that we played in leading to the passage of the Small Business Innovation Development Act of 1982, and its subsequent expansion to 11 other Federal agencies.

The program, we believe, provides a major opportunity for science and technology based small firms to participate in NSF sponsored research. It enables these firms to propose long-term, high risk, creative ideas within the NSF program areas that could only be pursued with outside support.

In addition, the NSF SBIR awards provide the basis which has helped the firms, these small high tech firms, attract private investment capital, obtain other R&D awards, and develop working arrangements with large industrial firms, venture capital investors, universities, and with State and local governments. And that's one of the elements that I think are so important with this cooperative research that we're doing, and that is to provide the linkages between the performer and the individual who can move this product and service into the marketplace.

The Small Business Innovation Research Program was developed at NSF in 1977 at the request of the Congress. At that time they asked that $1 million be expended from the applied research budget and put into the idea of some kind of a small business research program. From that evolved SBIR, and from that time until the 1987 budget which we anticipate, will be in the neighborhood of about $17.1 million. So over that period of time we've seen an increase of some 17 times in the total amount of money being spent in NSF for SBIR.

Since the inception of the program in 1977, NSF has invested some $41.6 million of Federal funds in the highest quality research proposals that we received under the annual solicitation. From 1977 to date, we have issued eight solicitations. These solicitations have generated a total of over 5,800 proposals, not including, we believe, about 1,000 proposals that were received at the Foundation yesterday when our newest solicitation, this NSF solicitation for 1986, closed. Sitting downstairs in our mailroom are about 1,000 proposals, which are in the midst now of getting ready to be reviewed and awards to be made out of new funds that will come out in 1987.

In the original group of solicitations that we had we made some 686 phase I awards and 216 phase II awards. And we're happy to announce that since 1977, small firms in 42 States and the District of Columbia have participated in the SBIR Program.

In my prepared testimony I've given not great detail, but some detail related to the distribution between phase I and phase II and these years. Perhaps during the question period if you'd like me to go into some detail I can show that. But let me just for one case take our last year, the year we're operating in right now.

We have made 126 phase I awards in this particular year, and up-to-date we have made some 62 phase II awards. We anticipate by the end of this year, and the expenditure of some $14.9 million, we will probably make a total of 75 phase II awards. That would suggest to you and suggest to us as a way of looking at the program that about one-third of our resources are put into phase I and two-thirds into phase II.

I know that was a question raised by Mr. Walgren in the question of carrying on this particular program. The SBIR Program has extensive university participation in both phase I and phase II, principally with consulting arrangements but also with some subcontracts. Last year—and we're talking about fiscal year 1986—we had 126 phase I awards, and there were 61 university collaborations. The largest number, four in each case, took place with Carnegie-Mellon University and at Cornell University.

In the previous year, with 108 awards, there were collaborations with 72 universities, and the largest number were with MIT, Stanford and the University of Delaware.

We believe that the SBIR Program is an effective means of coupling university basic research scientists to small high technology firms interested in and capable of converting government research into technology and new products.

As with all the agencies, as required by the act, the NSF solicitation was designed to assure that the quality of the awards made to small firms—not only to assure that quality, but also to provide incentives for the conversion of the federally sponsored research into technological innovation from the private sector, and to increase economic benefits from the government research.

We believe that the SBIR Program can serve both as a technical and a preventure capital base for ideas which, in addition to meeting government needs, have commercial potential.

The new solicitation, the one that I showed you before, for 1986 has all of the 22 research divisions involved in the National Science Foundation. So, we have brought the ability of the small firms to interact with all areas of the National Science Foundation in research. In some areas stronger than in other areas, but still a small firm with an innovative idea has an opportunity now to participate in all of our research programs.

Mr. LUNDINE. Excuse me.

Dr. SENICH. Yes, sir.

Mr. LUNDINE. We have—unfortunately we don't control our own lives around here to the extent we would like sometimes—we have a vote on. If you could wind up in the next minute or two, we'll go ahead and do that. Otherwise we can interrupt in the middle of your testimony——

Dr. SENICH. No problem, sir. Sir, I just want to point out to you that one of the issues that Mr. Mavroules raised was the one on—one funding commitment. This is an issue which we really want to stress with you, that one of the things that we find in the fourth item, and the objective is, to move the commercialization into the private sector. We believe that that 8-to-1 ratio leveraging of non-Federal funds to $1 of Federal funds is a good leverage rate, and provides us with the concept of moving an idea into the marketplace.

Mr. LUNDINE. I don't understand that. Explain that.

Dr. SENICH. Sir, in the first 4 years of the SBIR Program at NSF, we invested $18.4 million in the program. As a result of that $18 million we invested into the SBIR Program in these 4 years, we saw an investment of private-sector funds of $150 million. So we have a leveraging factor there of 8 to 1, and we think that's important.

The test of the research in many cases is that science and technology moved into the marketplace in the form of products and services, and that's best determined by the private sector.

In summary, sir, I think that we can say that we are pleased with what the foundation has seen and the SBIR Program is working as intended. We believe that the Small Business Innovation Act provides an opportunity for small high-technology firms to participate in meaningful research in the Science Foundation with an ability to move it to the private sector.

Thank you.

[The prepared statement of Dr. Senich follows:]

STATEMENT OF
DR. DONALD SENICH
DIVISION DIRECTOR
INDUSTRIAL SCIENCE AND TECHNOLOGICAL INNOVATION
NATIONAL SCIENCE FOUNDATION
BEFORE THE
SUBCOMMITTEE ON SCIENCE RESEARCH AND TECHNOLOGY
OF THE
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
JULY 16, 1986

INTRODUCTION

SMALL HIGH TECHNOLOGY FIRMS REPRESENT AN IMPORTANT NATIONAL RESOURCE. NOT ONLY ARE THEY AN IMPORTANT SOURCE OF INNOVATION AND JOB CREATION BUT THEY REPRESENT AN EXCELLENT MECHANISM FOR CONVERTING RESEARCH INTO TECHNOLOGY. FOR EXAMPLE, NSF ENCOURAGES QUALIFIED SMALL FIRMS TO COLLABORATE WITH UNIVERSITY SCIENTISTS AND ENGINEERS DOING BASIC RESEARCH IN THE SAME FIELD AS THE PROJECT THEY ARE SUBMITTING. SBIR ALSO COUPLES THE PERFORMING FIRM TO PRIVATE VENTURE CAPITAL TO PURSUE COMMERCIAL APPLICATIONS OF THE NSF SUPPORTED RESEARCH.

NSF ROLE IN DEVELOPMENT OF THE SBIR PROGRAM

WE ARE PROUD OF THE ORIGINAL DESIGN AND EARLY EXPERIMENTAL ROLE PLAYED BY THE NATIONAL SCIENCE FOUNDATION LEADING TO THE PASSAGE OF THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT OF 1982, P.L. 97-219 AND ITS EXPANSION TO ELEVEN OTHER AGENCIES. THE

PROGRAM IS CARRIED OUT IN THREE PHASES: PHASE I EXPLORES THE FEASIBILITY OF THE PROPOSED CONCEPT; PHASE II IS THE PRINCIPAL RESEARCH EFFORT; AND PHASE III IS THE PRODUCT DEVELOPMENT AND COMMERCIALIZATION STAGE.

THE PROGRAM PROVIDES A MAJOR OPPORTUNITY FOR SCIENCE AND TECHNOLOGY-BASED SMALL FIRMS TO PARTICIPATE IN NSF SPONSORED RESEARCH. IT ENABLES THEM TO PROPOSE LONG TERM, HIGH RISK CREATIVE IDEAS IN NSF PROGRAMS AREAS THAT COULD ONLY BE PURSUED WITH OUTSIDE SUPPORT. IN ADDITION, NSF SBIR AWARDS PROVIDE THE BASIS WHICH HAS HELPED THE FIRMS ATTRACT PRIVATE INVESTMENT, OBTAIN OTHER R&D AWARDS, AND DEVELOP WORKING ARRANGEMENTS WITH LARGE INDUSTRIAL FIRMS, VENTURE CAPITAL INVESTORS, UNIVERSITIES, AND WITH STATE AND LOCAL GOVERNMENTS.

THE SMALL BUSINESS INNOVATION RESEARCH PROGRAM WAS DEVELOPED AT NSF IN FISCAL YEAR 1977 WHEN CONGRESS DIRECTED THE NSF TO AWARD ABOUT $1 MILLION OF APPLIED RESEARCH FUNDS TO SMALL BUSINESS FIRMS. THE PROGRAM WILL GROW TO A LEVEL OF $17.1 MILLION IN FISCAL YEAR 1987 DUE TO THE REQUIREMENTS OF P.L. 97-219. THE LEGISLATION PRESCRIBES THAT 1.25 PERCENT OF THE FOUNDATION'S CURRENT EXTRAMURAL RESEARCH BUDGET BE

RESERVED FOR AWARDS TO SMALL BUSINESS CONCERNS THROUGH A UNIFORM PROCESS OF REVIEW AND MANAGEMENT. SINCE THE INITIATION OF THE SBIR PROGRAM AT NSF IN FISCAL YEAR 1977, NSF HAS INVESTED $41.6 MILLION OF FEDERAL FUNDS IN THE HIGHEST QUALITY RESEARCH PROPOSALS RECEIVED UNDER ANNUAL SBIR PROGRAM SOLICITATIONS.

NSF HAS ISSUED EIGHT SBIR PROGRAM SOLICITATIONS--1977, AND 1979 THROUGH 1985. THESE SOLICITATIONS GENERATED A TOTAL OF 5,821 PHASE I PROPOSALS NOT INCLUDING AN ESTIMATED 1000 FROM OUR 1986 SOLICITATION WHICH CLOSED LAST NIGHT. FROM THESE NSF HAS MADE A TOTAL OF 686 PHASE I AWARDS AND 216 PHASE II AWARDS TO DATE. SINCE 1977 SMALL FIRMS IN 42 STATES AND THE DISTRICT OF COLUMBIA HAVE PARTICIPATED IN THE NSF PROGRAM.

CURRENT SBIR ACTIVITY AT NSF

THE SBIR PROGRAM EXPENDITURES FOR FISCAL YEARS 1984 AND 1985 WERE $7.1 MILLION AND $12.4 MILLION BASED ON NSF'S ESTIMATED EXTRAMURAL RESEARCH BUDGETS OF $1,089 MILLION AND $1,247 MILLION RESPECTIVELY. IN FISCAL YEAR 1984, THE NSF MADE 102 PHASE I AWARDS OUT OF 1185 PROPOSALS SUBMITTED. IN FISCAL YEAR 1984, NSF MADE 53 PHASE II AWARDS, WHICH INCLUDED 34 NEW AWARDS

AND 19 CONTINUING GRANT ACTIONS. THESE PHASE II AWARDS WERE DRAWN FROM 81 PROPOSALS RECEIVED UNDER PREVIOUS SOLICITATIONS.

IN FISCAL YEAR 1985, THE FOUNDATION MADE 105 PHASE I AWARDS OUT OF 977 PROPOSALS SUBMITTED. IN FISCAL YEAR 1985, NSF MADE 64 PHASE II AWARDS, WHICH INCLUDED 33 NEW AWARDS AND 31 CONTINUING GRANT ACTIONS. THIS YEAR 126 PHASE I AWARDS AND 68 PHASE II AWARDS HAVE BEEN MADE TO DATE FROM THE $14.9 MILLION SBIR BUDGET.

THE NSF SBIR PROGRAM HAS EXTENSIVE UNIVERSITY PARTICIPATION IN BOTH PHASE I AND II, PRINCIPALLY WITH COUNSULTING ARRANGEMENTS BUT ALSO WITH SOME SUBCONTRACTS. LAST YEAR OF THE 126 PHASE I AWARDS THERE WERE 61 UNIVERSITY COLLABORATIONS. THE LARGEST NUMBER, FOUR IN EACH CASE, TOOK PLACE WITH CARNEGIE-MELLON AND WITH CORNELL. THE PREVIOUS YEAR IN 108 AWARDS THERE WERE COLLABORATIONS WITH 72 UNIVERSITIES. THE LARGEST NUMBER WERE WITH MIT, STANFORD AND THE UNIVERSITY OF DELAWARE. WE BELIEVE THE SBIR PROGRAM IS AN EFFECTIVE MEANS OF COUPLING UNIVERSITY BASIC RESEARCH SCIENTISTS TO SMALL HIGH

TECHNOLOGY FIRMS INTERESTED IN AND CAPABLE OF CONVERTING GOVERNMENT RESEARCH INTO TECHNOLOGY AND NEW PRODUCTS AND PROCESSES.

NSF SBIR SOLICITATION DESIGN

THE NSF SOLICITATION WAS DESIGNED TO ASSURE THE QUALITY OF AWARDS MADE TO SMALL BUSINESS FIRMS BUT ALSO TO PROVIDE INCENTIVES FOR THE CONVERSION OF FEDERALLY SPONSORED RESEARCH INTO TECHNOLOGICAL INNOVATION IN THE PRIVATE SECTOR TO INCREASE THE ECONOMIC BENEFITS FROM GOVERNMENT RESEARCH. SBIR RESEARCH CAN SERVE AS BOTH A TECHNICAL AND PRE-VENTURE CAPITAL BASE FOR IDEAS WHICH, IN ADDITION TO MEETING GOVERNMENT NEEDS, HAVE COMMERCIAL POTENTIAL.

THE NSF SBIR SOLICITATION IS ALSO DESIGNED TO PERMIT THE PROPOSING SMALL HIGH TECH FIRM TO SUBMIT RESEARCH PROPOSALS ON ADVANCED CONCEPTS THAT ARE CONSISTENT WITH THE SCIENTIFIC AND ENGINEERING OBJECTIVES OF THE FOUNDATION. THE CURRENT 1986 SOLICITATION CONTAINS TOPICS FROM ALL OF NSF'S 22 DISCIPLINARY RESEARCH DIVISIONS AND ALLOWS SMALL FIRMS TO COMPETE IN ALL RESEARCH AREAS GENERALLY SUPPORTED BY THE NSF. ADDITIONAL EMPHASIS IN THIS SOLICITATION IS GIVEN TO STIMULATE HIGH QUALITY RESEARCH IN FOUR AREAS OF

GROWING NATIONAL IMPORTANCE: BIOTECHNOLOGY, SCIENTIFIC INSTRUMENTATION, SUPERCOMPUTING, AND MANUFACTURING SYSTEMS.

PROPOSERS ARE ASKED TO CONSIDER WHETHER THE RESEARCH PROPOSED ON NSF PROGRAM OBJECTIVES ALSO HAS COMMERCIAL POTENTIAL. IF THEIR RESEARCH HAS SUCH POTENTIAL, ADDITIONAL CONSIDERATION IN EVALUATING THE PHASE II PROPOSAL IS GIVEN FOR PROPOSERS THAT PROVIDE CONTINGENT COMMITMENTS FOR NON-FEDERAL, FOLLOW-ON FUNDING FROM A THIRD PARTY, PREFERABLY IN THE PRIVATE SECTOR. THIS ALLOWS THEM TO PURSUE FURTHER DEVELOPMENT OF THE COMMERCIAL POTENTIAL AFTER THE GOVERNMENT FUNDING IS COMPLETED IN PHASES I AND II. NON-FEDERAL FUNDING PAYS FOR DEVELOPMENT FOR COMMERCIAL OBJECTIVES IN PHASE III.

NSF EXPERIENCE WITH FOLLOW-ON FUNDING COMMITMENTS

THE COMMITMENT FOR FOLLOW-ON CAPITAL OR OTHER FUNDING IS OBTAINED FROM A PARTY OF THE PROPOSER'S CHOICE. THE COMMITMENT IS NORMALLY CONTINGENT UPON THE RESEARCH ACHIEVING CERTAIN TECHNICAL OBJECTIVES MUTUALLY AGREED UPON BETWEEN THE SMALL BUSINESS AND THE PROVIDER OF THE FOLLOW-ON CAPITAL.

AT NSF, THE COMMITMENTS TO DATE HAVE TAKEN THE FORM OF VENTURE CAPITAL, LICENSING AGREEMENTS, CONTRACT R&D, JOINT VENTURES, R&D LIMITED PARTNERSHIPS, AND OTHER ARRANGEMENTS. OUR SBIR PROGRAM OFFICERS WORK CLOSELY WITH THE FIRMS TO MAXIMIZE THE CONVERSION OF THE SCIENCE DEVELOPED IN THE RESEARCH EFFORT INTO TECHNOLOGY. PHASE III FOLLOW-ON FUNDING COMMITMENTS INCLUDE SUCH COMPANIES AS GE, WESTINGHOUSE, DUPONT AND DOW CHEMICAL AND IN THE VENTURE CAPITAL AREA AMERICAN RESEARCH AND DEVELOPMENT, CONTINENTAL CAPITAL AND VENROCK.

IN THE 1984 AND 1985 SOLICITATIONS, 40 OUT OF 53 AND 60 OUT OF 64 PHASE II AWARDS, RESPECTIVELY, HAD ACCEPTABLE FOLLOW-ON FUNDING COMMITMENTS. DURING THE FIRST FOUR SOLICITATION YEARS OF THE PROGRAM AT NSF, THE $18 MILLION OF FEDERAL FUNDS EXPENDED WERE MATCHED BY PRIVATE SECTOR FOLLOW-ON FUNDING AMOUNTING TO $150 MILLION. THIS IS A LEVERAGING FACTOR OF 8:1 OF PRIVATE SECTOR TO FEDERAL FUNDS.

SIGNIFICANT EXAMPLES OF CONVERTING GOVERNMENT AND UNIVERSITY BIOSCIENCE INTO INDUSTRIAL PAY-OFFS

O IN 1977, NSF FUNDED A PHASE I PROPOSAL FROM COLLABORATIVE RESEARCH, INC. IN WALTHAM, MA FOR THE FIRST GENETICS RESEARCH CARRIED OUT BY THE COMPANY.

NSF MADE AWARDS OF $25,000 IN PHASE I AND A $239,000 IN PHASE II TO CONDUCT RESEARCH ON ENHANCEMENT OF ANIMAL PROTEIN PRODUCTION BY NOVEL GENETIC TECHNOLOGY. DOW CHEMICAL SUBSEQUENTLY INVESTED $11.5 MILLION IN THE SBIR FIRM. COLLABORATIVE RESEARCH, INC. HAD 33 PEOPLE AT THE TIME OF THE PHASE I AWARD AND RELATIVELY OLD FACILITIES. TODAY, THE FIRM HAS 135 EMPLOYEES AND LARGE NEW LABORATORIES IN LEXINGTON, MA. IT HAS ALSO GONE THROUGH TWO VERY SUCCESSFUL PUBLIC OFFERINGS AND IS A LEADER IN THE BIOTECHNOLOGY FIELD. IT HAS RAISED OVER $40 MILLION BASED ON THE INITIAL GENETICS RESEARCH CONDUCTED UNDER THE 1977 NSF SBIR AWARD. MORE RECENTLY THE COMPANY WAS THE FIRST TO IDENTIFY THE GENETIC MARKER FOR CYSTIC FIBROSIS. NOBEL LAUREATE DR. DAVID BALTIMORE IS CHAIRMAN OF THE COMPANY'S SCIENTIFIC ADVISORY COMMITTEE. THE COMPANY COLLABORATED WITH HARVARD SCIENTISTS ON THEIR RESEARCH AND WITH MASSACHUSETTS GENERAL HOSPITAL.

O NATIVE PLANTS, INC. OF SALT LAKE CITY, UT RECEIVED A PHASE I AWARD FOR RESEARCH ON A MYCORRHIZAL INOCULATED CONTAINERIZED PLANT GROWING SYSTEM IN 1980. THE COMPANY HAD 40 EMPLOYEES AND RECEIVED A $30,000 PHASE I AND RELATED $200,000 PHASE II AWARD. IT HAD AN INITIAL PHASE III

COMMITMENT OF AN EQUAL AMOUNT FROM A CHICAGO BASED VENTURE CAPITAL FIRM--F.H. PRINCE AND COMPANY. THE RESEARCH WAS HIGHLY SUCCESSFUL AND $1 MILLION OF VENTURE CAPITAL WAS INVESTED IN NATIVE PLANTS, INC. AS A RESULT OF THE SBIR AWARD. THIS AND OTHER SBIR AWARDS HELPED THE COMPANY OBTAIN AN ADDITIONAL $39 MILLION OF PRIVATE INVESTMENT IN THE FORM OF SEVEN R&D LIMITED PARTNERSHIPS AND INVESTMENTS BY FIVE LARGE INDUSTRIAL FIRMS. THE COMPANY NOW HAS 250 EMPLOYEES, OUTSTANDING NEW LABORATORIES IN A RESEARCH PARK ADJACENT TO THE UNIVERSITY OF UTAH CAMPUS, AND IS A WORLD LEADER IN THE FIELD OF PLANT GENETICS. IN ADDITION TO THE UNIVERSITY OF UTAH, NPI COLLABORATED WITH UTAH STATE AND THE UNIVERSITY OF CALIFORNIA-RIVERSIDE ON SBIR RESEARCH.

O VERAX CORPORATION OF HANOVER, NH RECEIVED A PHASE I AWARD OF $35,000 IN 1982 FOR RESEARCH ON LONG-LIFE CATALYSTS FOR IMMOBILIZED MICROORGANISM FERMENTORS. FOUR DARTMOUTH PROFESSORS IN BIOCHEMISTRY, BIOPHYSICS, MICROBIOLOGY, AND CHEMICAL ENGINEERING WERE INVOLVED AS CONSULTANTS. EARLY WORK WAS CARRIED OUT IN DARTMOUTH LABORATORIES LEASED BY VERAX USING STUDENTS AS PART-TIME EMPLOYEES. THE PHASE I RESEARCH WAS VERY SUCCESSFUL AND THE FERMENTATION PROCESS HAS BEEN SPEEDED UP BY A FACTOR

OF 10 AS A RESULT. VERAX THEN OBTAINED A FOLLOW-ON FUNDING COMMITMENT AND NOW HAS RECEIVED MORE THAN $10.1 MILLION IN NEW INVESTMENT. IT ALSO HAS A NEW LABORATORY, IS WORKING CLOSELY WITH MIT AS WELL AS DARTMOUTH AND RUTGERS SCIENTISTS AND IS ALREADY SELLING PRODUCTS TO MAJOR BIOLOGICAL AND PHARMACEUTICAL FIRMS. VERAX GREW QUICKLY FROM FOUR TO 110 EMPLOYEES AND SPUN-OFF TWO SEPARATELY FINANCED SCIENTIFIC INSTRUMENT FIRMS, ONE IN BIOTECHNOLOGY AND THE OTHER IN MEDICAL INSTRUMENTATION. VERAX NOW HAS 90 EMPLOYEES AFTER THE TWO SPIN-OFFS.

PROGRAM ASSESSMENT

SBIR IS WORKING WELL AT NSF. THE EXAMPLES REPRESENT ONLY A FEW OF THE MANY SUCCESSFUL COLLABORATIONS BETWEEN THE FEDERAL GOVERNMENT, SMALL HIGH TECH FIRMS, UNIVERSITIES, LARGE INDUSTRIAL AND VENTURE CAPITAL FIRMS. WE ARE CONVINCED THE PROGRAM IS WORKING AS INTENDED. SBIR WAS DESIGNED TO PROVIDE EXTRA VALUE TO THE NATIONAL ECONOMY FROM THE LARGE FEDERAL PRESENCE IN R&D. WE BELIEVE THAT SBIR FIRMS MAY DO BETTER THAN OTHER PERFORMERS OF FEDERAL R&D IN TERMS OF ECONOMIC VALUE RECEIVED DUE TO THE UNIQUE ENTREPRENEURIAL AND INNOVATIVE CAPABILITIES OF SMALL HIGH TECH FIRMS WHICH ALSO CONDUCT R&D AT LOWER COST.

THE EXTREMELY COMPETITIVE NATURE OF THE PROGRAM AS WELL AS THE BUILT-IN INCENTIVE TO UTILIZE THE GOVERNMENT RESEARCH AS A BASE FOR HIGH RISK IDEAS AND FOLLOW-ON PRIVATE SECTOR INVESTMENT ALSO CONTRIBUTE TO ITS EFFECTIVENESS.

CONCLUSION

SBIR IS FUNDING CUTTING-EDGE RESEARCH IN KEY TECHNOLOGY AREAS IMPORTANT TO THE ECONOMY THAT IN MANY INSTANCES ONLY THE GOVERNMENT SUPPORTS. IT IS AN OPPORTUNITY FOR RESEARCHERS WITH HIGH-RISK IDEAS FROM CREATIVE SMALL FIRMS WITH STRONG R&D CAPABILITIES TO WORK EFFECTIVELY WITH UNIVERSITIES, INDUSTRY, AND VENTURE CAPITAL FIRMS TO PROMOTE THE ECONOMIC COMPETITIVENESS AND TECHNOLOGICAL INNOVATION THAT FOR SO LONG HAS BEEN THE BACKBONE OF OUR INDUSTRIAL CAPABILITIES.

I WOULD BE PLEASED TO RESPOND FOR THE RECORD TO ANY QUESTIONS WHICH THE MEMBERS OF THE COMMITTEE MIGHT HAVE.

Mr. LUNDINE. Thank you very much. We will take a brief recess, as brief as we can, to go over and vote and return, and then we'll hear from the rest of the panel.

Thank you very much.

[Recess taken.]

Mr. LUNDINE. Dr. Decker, would you give us the Department of Energy perspective, please?

Dr. DECKER. Yes.

STATEMENT OF DR. JAMES F. DECKER, DEPUTY DIRECTOR, OFFICE OF ENERGY RESEARCH, DEPARTMENT OF ENERGY

Dr. DECKER. Thank you, Mr. Chairman. It's a pleasure for me to be here to represent the Department of Energy at this hearing. I have with me Dr. Richard Gajewski, who is the Department's program manager for the SBIR Program.

The SBIR Program has been in existence for almost 4 years. During that time we have issued four phase I solicitations, reviewed about 4,000 proposals, selected over 400 phase I projects, and over 100 phase II projects for funding. The total expenditures on the Department's SBIR Program have been about $75 million.

While it is too early to give you a full evaluation of this program, perhaps some of our experiences to date will be of interest.

One very positive aspect of our experience has been the high technical quality of the projects supported. It is the opinion of the Department's technical staff, who are involved in SBIR proposal review and selection, that the technical content of our SBIR projects compare favorably with projects supported by the Department outside of the SBIR Program.

Most of our SBIR projects do differ in nature, as they should, from work that's funded at universities and national laboratories. In developing technical topics for inclusion in an SBIR solicitation we must take into consideration the need to attract projects with a potential of going on to phase III, commercialization, or development of a product for the Government. This, of course, is not a consideration for our normal university and national laboratory projects.

Another positive feature has been the ability of small business to contribute to some of our high technology programs, such as high energy physics. The small businesses have been able to bring some very sophisticated techniques to bear on some of our difficult technology problems.

I believe that part of the reason for the high technical quality for SBIR Program has been a result of the way the Department has chosen to manage it. The Department's SBIR Program is centralized in the division of advanced energy projects in the Office of Energy Research.

SBIR funds from all departmental elements are merged into a single fund. The various technical programs in the Department then submit topics for inclusion in the annual SBIR solicitation. Proposals are selected for funding based on merit, rather than some predetermined distribution among the technical programs. This has created a very healthy competition among technical programs in the Department to be creative in submitting topics that will attract good proposals, and thus return to the individual technical programs results commensurate with their financial contribution.

We do try to obtain an overall program balance to match the Department's priorities. This is accomplished by making the number of technical topics placed in a solicitation roughly proportional to the respective technical programs contribution to the SBIR fund. Accordingly, there is more opportunity to submit proposals in areas which, by administration policy and congressional mandate, requires stronger emphasis.

The Small Business Innovation Development Act of 1982 requires that the Secretary of Energy provide to the Comptroller General his judgments as to the effect of the SBIR Program on DOE research programs for inclusion in the Comptroller General's report to Congress, which is due in July 1987.

We are presently undertaking a review of the DOE SBIR Program to meet that requirement. It is seldom easy to evaluate research and development programs because the resulting benefits in the form of new products and new processes often do not materialize as commercial successes until many years after the initial research and development are completed. There may well be some success stories after only a few years of SBIR funding. However, the real successes may not materialize until several years later.

While we would prefer to reserve final judgment on the effectiveness of SBIR until such time that the program could be fully evaluated, we know this may very well take several more years. In the meantime, the program should be allowed to proceed. And, accordingly, the Department of Energy would not object to an extension of the program.

I would like to make one comment on oversight. We feel that the oversight provisions that exist in the 1982 act are sufficient, that we really don't need anymore oversight.

Mr. Chairman, that concludes my remarks. I'd be happy to answer any questions.

[The prepared statement of Dr. Decker follows:]

Statement of James F. Decker

Deputy Director

Office of Energy Research

Department of Energy

before the

Subcommittee on Science, Research and Technology

Science and Technology Committee

U. S. House of Representatives

July 16, 1986

Mr. Chairman and Members of the Subcommittee:

It is a pleasure to appear before you today. First, I would like to provide comments on the Small Business Innovation Research (SBIR) program at the Department of Energy (DOE) and then to give the Department's position on H.R. 4260 that would repeal the Sunset provision of P.L. 97-219.

Over the almost four years of its existence, the SBIR program has matured significantly. We have by now issued four Phase I solicitations, reviewed about four thousand proposals, selected for funding over four hundred Phase I projects and well over one hundred Phase II projects; the first "cycle" of SBIR projects--those initiated for Phase I in FY 1983--has just come to completion. Thus, while it is still too early to attempt a full evaluation of the SBIR program, this may be a very opportune time to share with the Committee some of our experiences in implementing the program.

HIGH TECHNICAL QUALITY

Perhaps the most striking feature of the DOE SBIR program is the high technical quality of projects supported. DOE technical staff involved in proposal review and selection reports overwhelmingly that the weight of the technical contents of our SBIR projects is fully comparable with that of projects supported by the Department outside of SBIR. Quite obviously, most of our SBIR projects differ in nature, as they should, from work funded at universities and national laboratories; in formulating technical topics for inclusion in an SBIR solicitation, we are mindful of the need to attract projects with a potential of going into Phase III. Even so, comparisons of the degree of complexity, innovativeness and technical sophistication between our SBIR and non-SBIR projects can be made, and SBIR projects fare quite well in such comparisons.

MERGING FUNDS

The attainment of high technical quality of SBIR projects has been made possible by adopting the principle of merging contributions made to SBIR by different Departmental elements--contributions oftentimes derived from different appropriations--into a single SBIR fund. Thus we were able to entice the various technical programs into a healthy competition. By submitting well-designed topics for inclusion in the annual SBIR solicitation, and by publicizing the solicitation within the respective technical communities, the various programs can assure that funds contributed to SBIR will return to the respective programs in the form of SBIR-supported Phase I and Phase II projects.

PROGRAM BALANCE

While technical excellence is clearly the primary consideration in the DOE proposal selection process, we also have in place a mechanism which promotes overall program balance without sacrificing quality. Here the objective is to make the technical spectrum of DOE SBIR projects track as closely as possible the spectrum of Departmental priorities. This is accomplished by making the number of technical topics placed in a solicitation roughly proportional to the respective technical program's contribution to the SBIR fund. Accordingly, there is more opportunity to submit proposals in areas which, by Administration policy and Congressional mandate, require stronger emphasis.

Experience has taught us that excellent SBIR proposals can be encouraged in virtually every field of Departmental technical activity, including such seemingly esoteric technical areas as, for example, high energy particle physics. Managers of that program were able to identify subjects of vital interest to high energy physics which at the same time were most appropriate for SBIR work; examples include innovations in cryogenic technologies, superconducting wire fabrication and accelerator instrumentation. As a result, the high energy physics program, a major contributor to the SBIR program, is getting back the value of its monetary contribution to the SBIR fund in the form of SBIR projects of outstanding quality.

The number of SBIR Phase I proposals has declined from the first-year high of over 1,700 in FY 1983 to approximately 700 in FY 1986. Nevertheless, a thorough technical review of these proposals, conducted within the time constraints mandated by the Small Business Administration (SBA) Policy Directive, requires a highly concentrated effort on the part of many DOE technical staff members. The excellent cooperation on the part of various Departmental elements with the SBIR program provides convincing testimony as to the value of SBIR-selected projects to the DOE technical programs.

SOME VITAL STATISTICS

The accompanying table summarizes some DOE SBIR vital statistics. The following comments pertain to this table:

o The dollar discrepancy in the FY 1985 column, between the line "Amount Set-Aside for SBIR" and the line "Total Amount Spent on Phase I and Phase II Awards", results from the mechanism by which the SBIR set-aside was assessed. At the beginning of FY 1985, the Department determined the SBIR assessments based on the new budget authority which has been appropriated by Congress. This assessment was based on the amounts for extramural research and development in

VITAL STATISTICS OF THE DOE/SBIR PROGRAM

	FY 1984	FY 1985
Extramural R and D Budget (excluding DOE Defense Programs)	$2,613,300,000	$2,522,700,000
Amount Set-Aside for SBIR	$15,826,000	$25,227,000
Number of R and D Solicitations	1	1
Number of Phase I Proposals	844	861
Number of Phase I Awards	101	110
Amount Spent on Phase I Awards	$4,899,201	$5,416,713
Number of Phase II Proposals	96	91
Number of Phase II Awards	51	46
Amount Spent on Phase II Awards	$11,493,576*	$19,309,063**
Total Amount Spent on Phase I and Phase II Awards	$16,392,777	$24,725,776
Number of Identified Valid Follow-on Phase III Funding Commitments***	3	4

* Since Phase II awards are almost always funded in two years, this figure represents about half of the total dollars spent on the 51 Phase II projects initiated in FY 1984.

** This figure consists of about half of the total dollars spent on (1) the 51 projects started in FY 1984 and (2) the 46 projects started in FY 1985.

*** See comment on page 5 in the text.

programs other than the Defense Program which, by law, is exempted from participation in the SBIR program. At the end of the fiscal year, the Department determined the actual extramural funds obligated. The shortage in the original assessment will result in an adjustment to the assessment for the next fiscal year. Accordingly, in order to offset the FY 1985 shortfall, the Department will increase its FY 1986 assessment.

o "Number of Identified Valid Follow-on Phase III Funding Commitments." This number is determined by reviewing follow-on funding commitments only for proposals with lowest fundable merit scores, where the presence of a valid commitment is used as a tie-breaker, as stipulated by Public Law 97-219. The total number of Phase II proposals accompanied by follow-on funding commitments is clearly higher. However, those commitments are not examined unless there is a need to invoke them as tie-breakers.

SOME PROBLEMS

We would like to use this opportunity to bring to the Committee's attention two problems. These are:

Cost of Running SBIR - The SBIR program is highly labor-intensive. The need to process many hundreds of proposals every year and to provide them with a high-quality technical review places a heavy burden on the Department's resources. In addition, the Department engages in a sizeable outreach program: for two consecutive years now we have co-sponsored, with the National Science Foundation, major SBIR-oriented conferences, and we go to numerous meetings throughout the country to help bring the opportunities offered by the SBIR program to the attention of the small business community. Such activities are presently supported out of program direction funds. It would be most helpful to obtain a favorable interpretation of P.L. 97-219 permitting the use of SBIR program funds for SBIR program support purposes.

Property Acquired Under SBIR Contracts - Public Law 97-219 provides that title to Government-owned property may be transferred to the contractor if such a transfer would be more cost effective than recovery of the property by the agency. Yet, standard Government property regulations do not recognize the unique nature of the SBIR program. Consequently, we are encountering specific instances where the application of Government property regulations could pose a barrier to further development and eventual commercialization of products and processes resulting from SBIR research. For instance, it could be argued that we need to remove a vacuum pump from a bench-scale system developed under SBIR, which would hinder the chances of the contractor attracting non-federal funding to commercialize the system. We are presently working on solutions, consistent with all relevant statutes, that would allow the continued use, for a limited time, of Government-owned property by SBIR participants beyond Phase II in those instances where it can be determined that doing so would foster further development and eventual commercialization of the respective technology.

SBIR PROGRAM EVALUATION

Mindful of the requirement of P.L. 97-219 for the Secretary of Energy to provide to the Comptroller General his judgments as to the effect of the SBIR program on DOE research programs for inclusion in the Comptroller General's report to Congress (due in July of 1987), we are presently undertaking a review of the DOE SBIR program. In doing so, we recognize from experience that typically it takes many years to bring a technical innovation from the stage of exploratory research to commercialization. Thus, a great deal of patience needs to be exercised; while there very well may be some "success stories" shortly following the 2 1/2 years of SBIR funding, the real, significant accomplishments may not materialize until several years later. Accordingly, while the high technical quality of our SBIR projects gives us every reason to be optimistic about the program's eventual outcome, we must be careful to avoid the temptation either to seek "instant successes" that may be fleeting, or to make rush judgments about the commercialization resulting from SBIR research, where the time to accomplish commercialization clearly has been insufficient.

While we would prefer to reserve final judgment on the effectiveness of SBIR until such time that the program could be fully evaluated, we know that this may very well take several more years. In the meantime, the program should be allowed to proceed. Accordingly, the Department of Energy would not object to extension of the SBIR program.

Mr. Chairman, that concludes my testimony. I would be happy to answer any questions.

Mr. LUNDINE. Thank you.
Mr. Johnson?

STATEMENT OF HARRY W. JOHNSON, DIRECTOR, SMALL BUSINESS INNOVATION RESEARCH PROGRAM, NASA

Mr. JOHNSON. Mr. Chairman, thank you for the opportunity to be here for NASA's report. Our Small Business Innovation Research Program is now in its fourth year, as are most agencies. Our solicitation this year closed at the end of June, and this solicitation included 15 major topics and some 183 subtopics in which we were inviting proposals. Each of these areas, or the total areas represented almost the entirety of everything that NASA is interested in in its R&D programs.

The response to this solicitation set a new record with 40 percent more proposals being received than last year. Our first count indicates that more than 1,630 proposals were received from nearly 1,000 small businesses located in 44 States, the District of Columbia and Puerto Rico, responding to more than 170 of the subtopics that I mentioned.

The detailed evaluation of these proposals by our 9 field centers will begin next week, culminating in the announcement of about 120 phase I award selections this fall. While the exact number of those selections will depend on our understanding of the fiscal year 1987 SBIR funding authority at that time, it will depend even more heavily on whether the current SBIR sunset date is in effect.

Sunset extension would permit us to increase not only the number of phase I awards from this group of proposals, but also increase the number of phase II awards as follow on to last year's phase I program. I'll comment further on this in a moment.

NASA's SBIR Program statistics for the first 3 years are listed in tables I and II attached to my statement. Incidentally, I would request that my entire written statement be——

Mr. LUNDINE. Yes. All of your written testimony will be made a part of the record in its entirety.

Mr. JOHNSON. Thank you. Table I lists the numbers of phase I and II proposals received, awards made or currently being negotiated, funds applied to each year as phase I and II programs, and the average award values.

Phase I proposals selected for award in 1983, 1984, and 1985 programs totaled 379, and 129 phase II award selections were made as follow on to the first 2 years programs. We anticipate that at least 60 phase II awards will be made in November of this year as follow on to last year's phase I program, and more awards if the sunset date is repealed or deferred.

The distribution by State of the 508 total awards made by NASA to date is shown in the attached figure. This includes some 34 States and the District of Columbia. While by no means perfectly correlated with the number of proposals received, the geographical distribution of the awards shown clearly suggests where the major areas of interest in our program lie.

Table II lists NASA's annual research and development annual budgets and the portions which were allocated for each fiscal year to the SBIR Program. The funds actually expended or obligated in fiscal years 1984 and 1985 are shown, and there are differences between those numbers and the SBIR budget allocations for the fiscal years 1984 and 1985 listed in table II, which result from the inherent phasing requirements of the program. R&D funds set aside for SBIR in any fiscal year may support portions of three annual programs. This distribution, this fact, is not completely understood by everyone.

Table I also shows the numbers of phase II proposals and awards for which phase III follow on funding commitments were identified. Approximately 57 percent of all the proposals we received and 58 percent of all the phase I awards made indicated such phase III commitments.

Active interest in the NASA SBIR Program continues to increase, as indicated by both the increased number of phase I proposals received and the number of requests for the annual program solicitation which we receive. Our distribution this year was 14,000 and, in addition to those, we distributed a number through our field centers and at conferences we attend. The total number this year will be 17,500 solicitations distributed, in contrast to 14,000 last year.

With regard to assessing our program, I should comment that while we're entering the fourth program year, it must be noted that many phase II contracts, which represent the principal R&D activities, of course, and which may have 2 years program duration, most of these are only now getting underway.

The first group of phase II contracts from the 1983 program year was placed during the last 18 months, and a number of the second group, the 1984 program year, were selected last November. Many of these are still being negotiated, in fact.

At this time, only one or two phase II contracts have been completed out of our entire set. Therefore, it's too early, we feel, to evaluate the technical program comprehensively or to predict accurately the ultimate value of the R&D either to NASA or to the small business firms involved in the program. Nevertheless, some preliminary findings and views are available, and these are quite positive.

Since the enactment of the SBIR statute, NASA research personnel and their management have developed strong support and enthusiasm for the program. NASA has found that a great number of new and attractive approaches to problems and opportunities identified in the program solicitation have, in fact, been offered by a large number of innovative small firms. Many of these ideas have not previously been volunteered to NASA, and possibly might never have been offered in the normal course of events without SBIR.

The SBIR opportunity and stimulus made it possible for them to reach NASA's attention and to be funded. Of course, a number of proposals received each year have been judged not to have great merit. That's understandable. Nevertheless, we are greatly pleased with the high incidence of high quality, carefully developed R&D proposals resulting from the solicitations, and we fully expect that the end results and products from these contracts will be quite valuable.

One clear conclusion, based on 3 years of experience in the program to date, is that the SBIR phase I, phase II approach and program management philosophy have provided a very cost effective means for exploring new ideas rather quickly. The rapid response capability of SBIR small businesses and their generally high motivation and skill levels have proved to be genuine assets in our program.

SBIR contract efforts are viewed as integral and important elements in the overall program in NASA, although, of course, representing only a small fraction. Among our SBIR projects are the development of numerous analytical methods, computer software concepts, and hardware designs for direct use by NASA in our overall program. Many of these projects have much broader application potential and commercial prospects.

Later this year, as the most recently awarded phase II contracts get underway and as the earlier ones mature, we will begin a comprehensive assessment of the technical impact of SBIR on the NASA program as is required by law. As my previous remarks suggest, we fully anticipate the results to be very positive.

With regard to the nontechnical objectives of SBIR, as outlined in the statute, we also think it's somewhat premature to estimate their successful achievement at this moment. But, as with the technology aspects of the program, our preliminary view is positive. As noted previously, it seems clear that SBIR has been successful in drawing many small businesses into the program. About 250 small businesses have been awarded SBIR contracts by NASA so far, and more than half of these are new to the NASA program.

There is also evidence that the SBIR objective of fostering commercialization of innovations already appears to be successful in a number of instances. Although we have not yet attempted to collect and digest data on this objective, several of the firms in the program have indicated informally and volunteering this information to us that they have acquired viable commercial capabilities and financial backing as a direct result of the R&D that they pursued in our, and in other agencies', SBIR programs.

Finally, there is also evidence that the objective of encouraging greater participation of minority and disadvantaged persons in NASA's program is being achieved. During fiscal year 1985, 11.6 percent of the SBIR funding obligations went to minority and disadvantaged small businesses. The number is significant because disadvantaged and minority status is deliberately not considered as an evaluation, eligibility or preference criterion in our award selection process.

Our management experience with SBIR is thus far quite satisfactory. Through the cooperation of our field centers and by sharing and benefitting from the experiences of other participating agencies, procedures we now have have continuously evolved and have been refined. We experience no unique difficulties in implementing the program and are pleased with the smoothness of the program's conduct and its acceptance at our field centers.

I'd like to make a few comments on the sunset considerations. I commented earlier that the numbers of phase I and phase II awards we will make later this year will depend significantly on whether the current sunset date is still in effect. Existence of sunset is important that far in advance because of funding requirements timing for phase II projects, which start a year or more after their precursor phase I awards.

With the current sunset date in effect, we must provide for completion of phase II projects initiated as long as 2 years before the sunset date, in other words. This means that phase II projects resulting from the 1985, 1986, and 1987 calendar year solicitations will require the bulk of fiscal year 1987 and 1988 funding allocations for SBIR, and the latter contracts for 1987 will extend at least into 1990, well past the point and the sunset date, in other words, where new SBIR funding is available.

And, further, because there could be no meaningful program solicitation in 1988 because of the—no additional funds in the program and our inability to fund phase II programs subsequent to the last year of SBIR funding—I didn't make that a complete statement. I hope you understood what I was saying.

Mr. LUNDINE. I think I understood it. That may be the most lively issue that we have about this program, so we appreciate your perspective on it.

Mr. JOHNSON. If the sunset date were extended in the next few months, the immediate effect would be our ability to select larger numbers of phase I awards from this year's bumper crop of proposals, perhaps an additional 30 or more. We would also be able to select a significantly greater number of phase II awards this fall, perhaps more than 70 total from the group of nearly 150 phase II proposals now being prepared by our 1985 program year phase I contractors.

In summary, considering all the positive indications that we have on our SBIR program, and despite the fact that our indepth program assessment has yet to be made, nevertheless, we feel that the program is valuable and should be continued. Accordingly, we support extension of the sunset date, or a reauthorization for a period of time.

This concludes my formal statement. I would be happy to answer any questions you may have.

[The prepared statement of Mr. Johnson follows:]

National Aeronautics and
Space Administration

Hold for Release Until
Presented by Witness

July 16, 1986

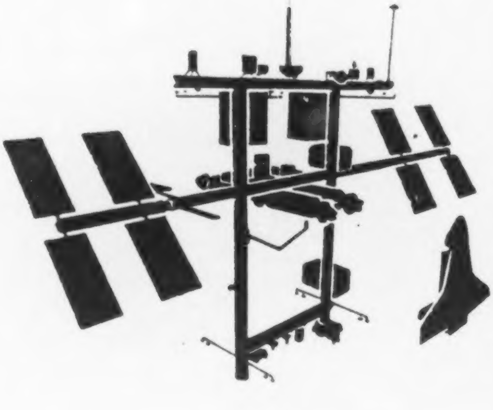
Subcommittee on Science, Research & Technology

Committee on Science & Technology

U.S. House of Representatives

Statement by:

Mr. Harry W. Johnson
Director, Small Business
Innovation Research Office



99th Congress

Hold for Release until
presented by witness on
July 16, 1986

Statement of

Harry W. Johnson
Director, Small Business Innovation Research
Office of Commercial Programs
National Aeronautics and Space Administration

before the

Subcommittee on Science, Research and Technology
Committee on Science and Technology
House of Representatives

Mr. Chairman and Distinguished Members of the Subcommittee:

NASA's Small Business Innovation Research (SBIR) Program has begun its fourth annual cycle. Each cycle begins with an annual SBIR Program Solicitation, published in the spring, inviting Phase I proposals in all topics and subtopics of interest to NASA. The 1986 Program Solicitation period began the first of May and closed on June 30. The Solicitation included 15 technical topics subdivided into 183 subtopics encompassing every area of aeronautics and space technology in which NASA is involved.

The response to this solicitation set a new record, with 40 percent more proposals received than last year. Our first count indicates that more than 1630 proposals were received from nearly 1000 small businesses located in 44 states, the District of Columbia and Puerto Rico, responding to more than 170 of the subtopics solicited. The detailed evaluation of these proposals by 9 field Centers will begin next week, culminating in the announcement of about 120 Phase I award selections this Fall. While the exact number will depend on our understanding of FY 1987 SBIR funding authority, it will depend even more heavily on whether the current SBIR sunset date is in effect. Sunset extension would permit us to increase not only the number of Phase I awards from this group of proposals, but also the number of Phase II awards as follow-on to last year's Phase I program. I will comment further on this situation later in my testimony.

PROGRAM STATISTICS

NASA'S SBIR program statistics for the first 3 years are listed in Tables I and II. Table I lists the numbers of Phase I and II proposals received, awards made or currently being negotiated, funds applied to each year's Phase I and Phase II programs, and the average award values.

Phase I proposals selected for award in the 1983, 1984, and 1985 programs totalled 379, and 129 Phase II award selections were made as follow-on to the 1983 and 1984 Phase I contracts. We anticipate that at least 60 Phase II award selections will be made in November 1986 as follow-on to the 1985 program Phase I contracts, and more if sunset is repealed or deferred.

The distribution by state of the 508 Phase I and Phase II awards made by NASA to date is shown in Figure 1. While by no means perfectly correlated with the number of proposals received, the geographical distribution of awards clearly suggests where the major areas of interest in our program lie.

Table II lists NASA's annual research and development (R&D) budgets and the portions allocated each fiscal year to the SBIR Program. The funds actually expended (obligated) in fiscal years 1984 and 1985 were $4.980M and $29.403M, respectively. Differences between those numbers and the SBIR budget allocations for fiscal years 1984 and 1985 shown in Table II result from the inherent phasing requirements of the program. R&D funds set aside for SBIR in any fiscal year may support portions of three annual programs.

Table I also shows the numbers of Phase II proposals and awards for which Phase III follow-on funding commitments were identified. Approximately 57 percent of all Phase II proposals and 58 percent of all Phase II awards indicated such commitments.

Active interest in NASA's SBIR Program continues to increase, as indicated by both the increased number of Phase I proposals received and the number of requests for the annual Program Solicitation. Our Solicitation distribution list is based largely on written requests, and exceeds 14,000 this year; this is about 30 percent larger than last year's list. In addition to our mailing list, many other copies of each annual Solicitation are distributed by our Field Centers, and others are provided to attendees at many SBIR outreach conferences sponsored throughout the year by Federal and State groups, in which NASA participates. Some 17,500 Program Solicitation documents will have been distributed this year, compared to 14,000 last year.

PROGRAM ASSESSMENT

Although we are entering the fourth program year, it must be noted that many Phase II contracts, which represent the principal R&D activities, and which may have 2 year durations, are only now getting underway. The first group of Phase II contracts (1983 Program Year) was placed during the last 18 months, and a number of the second group, the 1984 Program Year Phase II contracts which were selected last November, are still being negotiated. At this time, only one or two Phase II contracts have been completed. Therefore, it is too early to evaluate the technical program comprehensively, or to predict accurately the ultimate value of the R&D either to NASA or the small business firms involved in the program. Nevertheless, some preliminary findings and views are available, and these are quite positive.

Since the enactment of the SBIR statute, NASA research personnel and their management have developed strong support and enthusiasm for the program. NASA has found that a great number of new and attractive approaches to problems and opportunities identified in the Program Solicitation have been offererd by a large number of innovative small firms. Many of these ideas had not previously been volunteered to NASA, and possibly might never have been offered in the normal course of events. The SBIR opportunity and stimulus made it possible for them to reach NASA's attention and to be funded. Of course, a number of proposals received each year have been judged not to have great merit; nevertheless, we are greatly pleased with the high incidence of high-quality, carefully-developed R&D proposals resulting from our Solicitations, and fully expect that the end results and products will be quite valuable.

One clear conclusion, based on 3 years of experience in the program, is that the SBIR Phase I - Phase II approach and program management philosophy have provided a very cost-effective means for exploring new ideas rather quickly. The rapid response capability of our SBIR firms, and their generally high motivation and skill levels, have proved to be genuine assets in our overall program. SBIR contract efforts are viewed as integral and important elements of the overall NASA R&D program, albeit comprising a relatively small total increment. Among our SBIR projects are the development of numerous new analytical methods, innovative computer software concepts, and hardware designs for direct use by NASA in our total R&D and operational program activities. Many of these projects have much broader application potential and commercial prospects. Later this year, as the most recently awarded Phase II contracts get underway and as the earlier ones mature, we will begin a comprehensive assessment of the technical impact of SBIR on the NASA program. As my previous remarks suggest, we fully anticipate the results to be quite positive.

With regard to the non-technical objectives of SBIR outlined in the statute, we also think it somewhat premature to estimate their successful achievement at this time. But, as with the technology aspects of the program, our preliminary view is positive. As noted previously, it seems clear that SBIR has been successful in the objective of drawing many small businesses into the NASA program. About 250 small businesses have been awarded SBIR contracts by NASA, and more than half of these firms are new to the NASA program. There is also evidence that the SBIR objective of fostering commercialization of innovations already appears to be successful in a number of instances. Although we have not yet attempted to collect and digest data on this objective, several of the firms in the program have indicated informally that they have acquired viable commercial capabilities and financial backing as a direct result of R&D they have pursued in our (and other agencies') SBIR programs.

Finally, there is also evidence that the objective of encouraging greater participation of minority and disadvantaged persons in NASA's program is being achieved. During fiscal year 1985, 11.6 percent of the SBIR funding obligations went to minority and disadvantaged small businesses. The number is significant because disadvantaged or minority status is deliberately not considered as an evaluation, eligibility or preference criterion in our award selection process.

Our management experience with SBIR is thus far quite satisfactory. Through the cooperation of our field Centers and by sharing and benefitting from the experiences of other participating agencies, the procedures we now use have continuously evolved and have been refined. We experience no unique difficulties in implementing the program, and are pleased with the smoothness of the program's conduct and its acceptance at our field Centers as a desirable part of their programs.

SUNSET CONSIDERATIONS

I commented earlier that the numbers of Phase I and Phase II awards we will make later this year will depend significantly on whether the current sunset date is still in effect. Existence of sunset is important that far in advance because of funding requirements timing for Phase II projects, which start a year or more after their precursor Phase I awards. With the current sunset date in effect, we must provide for completion of Phase II projects initiated as long as two years before the sunset date. This means that Phase II projects resulting from the 1985, 1986 and 1987 calendar year solicitations will require the bulk of FY 1987 and FY 1988 SBIR funding allocations, and the latter contracts will extend at least into 1990, well past the point (the sunset date) where new SBIR funding is available. Further, there could be no meaningful program solicitation in 1988 because of the impossibility of subsequent Phase II funding.

If the sunset date were extended in the next few months, the immediate effect would be our ability to select larger numbers of Phase I awards from this year's bumper crop of proposals, perhaps an additional 30 or more. We would also be able to select a significantly greater number of Phase II awards this Fall, perhaps more than 70, from the group of nearly 150 Phase II proposals now being prepared by our 1985 program year Phase I contractors.

RECOMMENDATION

Considering all the positive indications we have on our SBIR program, and despite the fact that our in-depth program assessment has yet to be made, we feel that the program is valuable and should be continued. Accordingly, we support extension of the sunset date, or a reauthorization for a period time.

This concludes my formal statement. I would be happy to answer any questions the Subcommittee may have.

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PROGRAMS

NASA SBIR PROGRAM STATISTICS FOR FIRST THREE PROGRAM YEARS

TABLE I

PROGRAM SOLICITATION YEAR	PHASE I				PHASE II						TOTAL PROGRAM FUNDING $M
									PHASE III FUNDING COMMITMENTS		
	PRO-POSALS	AWARDS	TOTAL FUNDING $M	AVERAGE FUNDING $K	PRO-POSALS	AWARDS	TOTAL FUNDING $M	AVERAGE FUNDING $K	TOTAL	AWARDS	
1983	977	102	4.93	48.3	92	58	23.77	410	54	37	28.70
1984	919	127	6.23	49.1	113	71	32.91(1)	463(1)	62	38	39.14(1)
1985	1164	150	7.43	49.5	NA	NA	32.0(2)	NA	NA	NA	39.43(2)
TOTALS TO DATE	3060	379	18.59	49.1	205	129	88.68(2)	439	116	75	107.27(2)

NOTES: (1) 1984 Program Year Phase II and Total Funding are estimates pending completion of Phase II contract negotiations.

(2) 1985 Program Year Phase II awards will not be made before late 1986. Phase II and total funding are estimates.

OCP-0897

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NASA SBIR FISCAL YEAR FUNDING

TABLE II

	FISCAL YEAR 1983	FISCAL YEAR 1984	FISCAL YEAR 1985	FISCAL YEAR 1986
NASA R&D BUDGET - $M	2473	2205	2425	2609
% R&D BUDGET FOR SBIR	0.2	0.6	1.0	1.25
NASA SBIR BUDGET - $M	4.94	13.23	24.25	32.61

NASA
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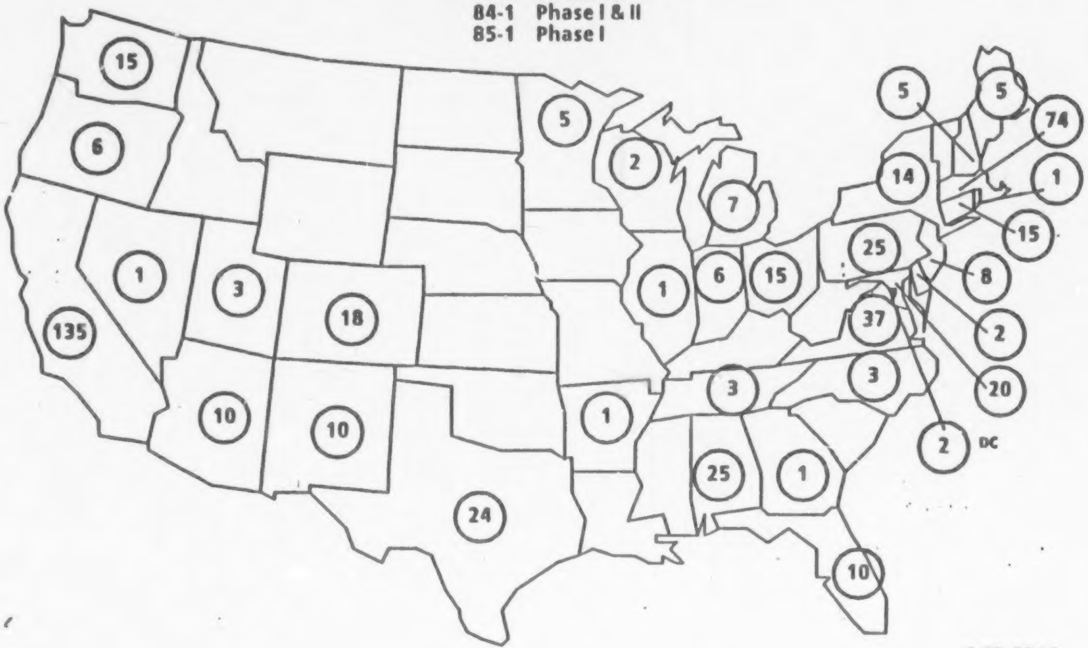
NASA SBIR AWARD DISTRIBUTION BY STATE

FIRST THREE PROGRAM YEARS:

83-1 Phase I & II
84-1 Phase I & II
85-1 Phase I



OCP-0214
1/28/86

FIGURE 1

Mr. LUNDINE. I want to thank you for your testimony. You've basically confirmed what I came here thinking, but you've added a new focus and very important perspective for me.

I'm going to turn the gavel—you see, the fact that Mr. Walgren and then Lundine and then Brown are here is a factor of greater interest in the subject, not just that we're playing musical chairs with the chairmanship. But my colleague from California has been certainly one of the great innovators in the Congress and has been deeply involved in this program, and I'm going to turn the gavel over to him.

But before I do, I'd like to ask unanimous consent that I may be permitted to put an opening statement in the record following the chairman and the ranking minority member's statement. Without objection, I'll get that done and turn it over to George for questions.

Mr. BROWN [acting chairman]. Mr. Boehlert, do you have any questions?

Mr. BOEHLERT. I do. Dr. Senich, does this program enable NSF to fund different kinds of research or are you funding the same research with different grantees?

Dr. SENICH. Sir, it allows us to fund research which—if you're looking at basic research and the concept of research for knowledge, for its opportunity, very long-term potential—which is the role of the National Science Foundation—is one thing.

What this particular program does is allow you to do fundamental long-term research which has an application, a potential commercial application. And that, I think, is a somewhat different perspective on how we address proposal and funds. So, I think what we do is different than what would normally be supported in the Foundation.

Mr. BOEHLERT. Is it concentrated in a few disciplines?

Dr. SENICH. No—well, yes, sir. Let me step back slightly. I would say of the proposals 45 to 50 percent of the proposals come in in five engineering divisions. The other 50 percent of the proposals come in the rest of the Foundation, those other 22 divisions I talked about. The other 22 divisions get the other 50 percent of the proposals; the largest number being in materials research, in computers, and in biotechnology.

And so, as you look at those, sir the spread is wide. I wish that perhaps your colleague Mr. Wirth were here. We funded in chemistry a particularly exciting concept on a Redox Chemiluminescence Detector, which permits an examination of organic materials which otherwise wouldn't be easily detected. That particular research done in a Boulder laboratory is now finding its way into Exxon, Sohio and university laboratories as a detector—and at EPA—that may find its way into EPA uses. Things that otherwise wouldn't be funded are funded.

So, the biggest ones are in engineering, materials research and in biotechnology, all of which are stressed in our budget to the committee. In fact, these are areas that we also stress.

Mr. BOEHLERT. In the past NSF has looked for SBIR money for administrative costs. This time around you're not focusing on that. Is that no longer a problem?

Dr. **Senich**. No, sir. We did not include that in the testimony. When we testified before Mr. Mavroules' committee and in front of Mr. Rudman, some of our thoughts were that it takes some resources, a very small amount of resources, to give the program some ability to do its job.

We must pay, for example, for the printing of the solicitation for the solicitation distribution. We have to pay for the two small high tech conferences which we have every year. We also would like a very small amount of money to look at the third issue in the objectives, and that is to work and to encourage more minorities to participate. But the total amount of money that we would look for wouldn't exceed perhaps $150,000 a year.

But yes, it's true that we have talked to the members of the SBA about that and to Mr. Rudman, but I didn't think it was appropriate for the testimony today.

Mr. **Boehlert**. Thank you very much.

Mr. **Brown**. Mr. Ritter?

Mr. **Ritter**. Thank you, Mr. Chairman. I apologize for having missed this most recent testimony. I would like to ask a question to some of the program chairmen here, and that is, what is the impact on the process of securing a grant and engaging in the bureaucratic necessities of securing a grant on the progressive innovation in these small outlets?

I'm a very strong supporter of this concept of SBIR. If I would have one concern, it would be that you engage a lot of very small companies that don't have accountants, they don't have grant writers, they don't have those kinds of personnel.

How has that impacted the small companies that you deal with?

Dr. **Gajewski**. If I may, the process is extremely simple. We specify in the solicitation that we require that the proposal is not to exceed 25 pages. There are no preaward audits for phase I. There are preaward audits for phase II. Phase I is an extremely simple process, and we get overwhelming reports from our successful grantees that the mechanics of applying for a grant is really not a problem.

Mr. **Ritter**. I think this is a very important point to this committee because we have been increasingly concerned about the amount of time and effort spent by, for example, some of the best university faculty in securing their R&D support base.

What you're saying is that this program is quite different from the normal R&D contract and grant bureaucratic procedure.

Dr. **Gajewski**. Yes, it is.

Mr. **Ritter**. What is the average turnaround— what is the kind of turnaround time between proposing an idea through SBIR and actually receiving funding?

Dr. **Gajewski**. In our agency it's a maximum of 6 months, and we will usually beat that length.

Mr. **Ritter**. Six months.

Dr. **Gajewski**. Right.

Mr. **Ritter**. So there's a 6-month period during which, essentially, the innovation process is on hold?

Dr. **Gajewski**. No, let me explain here. We would have a proposal—we would have a solicitation issued say in February, we would have the results—as it happened last year—we would have the results announced in July, we would have everybody under contract in September. So that's how it worked this year. Now, this is for phase I.

In phase II, we have——

Mr. **Ritter**. So the time between submission and receiving of a grant, what is that time?

Dr. **Gajewski**. It's between February 15, say, and September 15.

Mr. **Ritter**. So the deadline on submission is February 15, September 15 is the award announcement?

Dr. **Gajewski**. Right. No, not the award announcement. It's the day on which the grant, the selected applicant receives a contract. I mean, the announcement is some 2 months earlier. You see, the contracting office needs time to process the paper, but that's between 6 weeks and 2 months.

Mr. **Ritter**. Dr. Senich, you want to comment on that?

Dr. **Senich**. Sir, let me give you an example of what's going to happen this year. We put out our solicitation on the streets on the 15th of April. Our closing date was the 15th of July. We will make our awards on the 1st or, at the latest, by the 15th of January. The announcements and the awards will be in the hands of the grantees by the 15th.

And in some cases, sir, where they are easily reviewed and we can get them in the system, they will probably be in the hands of the proponent by the middle of December.

Mr. **Ritter**. So for you it's a kind of 9 month, 6 to 9 month——

Dr. **Senich**. That's from the issuance of the solicitation to the award. From the time the proposal gets turned in, it's between 5½ and 6 months.

Mr. **Ritter**. OK. So basically you don't see a kind of bureaucratic hitch or interruption in the process of innovation with the organizations that you deal with.

Dr. **Senich**. Sir, can I just add one thing?

Mr. **Ritter**. Sure.

Dr. **Senich**. I think Dick and I are both talking about, and Roland would even say, we're talking about the phase I awards. The principal research in phase II takes more time. From the time a proposal is submitted at the end of its phase I, it goes through a very thorough review at the Science Foundation. The review procedures for phase II are the same procedures as any university research proposal would receive. They're the same, everything is the same at that point.

The one additional——

Mr. **Ritter**. What's the time lag there?

Dr. **Senich**. Sir, it's about 6 months. However, I can and I must say to you in honesty that there is somewhat of a delay in addition to it, or there could be a delay because of our concern that the small firm obtain a follow-on funding commitment or attempt to obtain a follow-on funding commitment.

Our concern is that without this follow-on funding commitment, the ability to move it the concept to the marketplace is somewhat impaired. But that does not mean that you would not get an award without a follow-on funding commitment. We have the case of the Applied Superconductivity in Pasadena, CA doing some work on acceleration of heavy ions. The user of that research is Tata Institute, Cambera, Cambridge, Argonne, Brookhaven, and Lawrence Berkeley, too.

But, you know, it's not a necessity, but we encourage the investigator to go out and obtain a follow-on funding commitment, whether it be venture capital, a large firm, or a private investor of some type. We really are trying to push that. So, it may delay it a little longer.

Mr. **Ritter**. Is there a sense of a partnership between the entrepreneur of the individual organization and the funding agency to seek follow-on funding commitments? Do you help?

Dr. **Senich**. This is the role that Mr. Tibbetts plays, sir. That's one of the roles that Mr. Tibbetts plays is to work with them to encourage them, to assist them in obtaining the strongest possible follow-on funding commitment.

Mr. **Ritter**. OK, thank you.

Mr. **Brown**. Mr. Cobey?

Mr. **Cobey**. No questions.

Mr. **Brown**. A couple of you gentlemen have referred to the evaluation process that will be necessary after we've had some experience with this program. As I recall at the inception of the legislation, we felt that NSF had demonstrated the value of this program and that it should be expanded to other agencies.

We do need to evaluate the success of the other agencies and, in effect, what did we get for the money invested in this program. Tell me how you're going to do that and when you will be able to accomplish that if the legislation is extended. I'd like to address that question to Dr. Decker and Mr. Johnson primarily.

Dr. **Decker**. We have initiated an evaluation which is required by the act of 1982. It will be done by an independent group within the Department that does program evaluations. It will be an evaluation that will try to meet the requirement of the act, which is really the effect of the SBIR on the Department's research programs. And that's the extent of our plan at the present time.

Mr. **Brown**. When do you expect to be able to get into that?

Dr. **Decker**. We have just——

Mr. **Brown**. Assuming a continuation of the program.

Dr. **Decker**. Yes. We have just initiated that review on—I don't know. Do you have the timeframe?

Mr. **Gajewski**. Well, the review will be conducted over the next 6 months, or so. The protocol for the review is just about to be formulated.

Mr. **Brown**. But I gather that you don't have enough experience with phase II and phase III to be able to give a total evaluation.

Dr. **Decker**. That's correct.

Mr. **Brown**. Mr. Johnson, what's your situation?

Mr. **Johnson**. As I mentioned in my testimony, Mr. Brown, I think at this point only two of our phase II contracts have matured, although we have some pretty good feelings about many that have not yet completely finished.

Mr. **Brown**. We need more than feelings, don't we?

Mr. **Johnson**. Well, we need a little bit more than 2 out of a total of 129 to draw any significant conclusions. As soon as the dust settles on our current evaluation, when we get out from under the 1,630 proposals in phase I—which will be this fall—we will begin a fairly intensive effort toward evaluating the total program, not just because that's convenient for disposing of the phase I crop, but because by that time there will be a number of phase II contracts from our 1983 program that will have been completed.

We're particularly interested in two aspects of this. One is how this work has really supplemented the NASA program that would have been there anyway, and what we would find, we hope, is that there will be things that were done that could not have been expected to happen quite so readily in the normal program. We have evidence that that's already the case. I could mention two or three examples to illustrate the point, although it's not really important to do this, but we have a number of things right now that we could illustrate the point with.

The second thing is we're quite interested in knowing how the commercialization opportunities have materialized, or if they've materialized. Since we are a mission agency as in contradistinction, perhaps, to the National Science Foundation in this regard, it's almost inevitable that most of our research managers look first of all for applicability to the NASA program in their recommendations for contract selections. That's quite natural and, as a matter of fact, it's one of the requirements of the statute, is that the program that we select be related to the NASA, or to the agency's objectives and program.

But it's not always inevitable that something that's of interest to NASA will also have commercial potentials. We hope that they do and we try to make this possible wherever we can. But we are interested in assessing that in particular because we know that that was one of the primary reasons for the SBIR legislation in the first place.

We will be doing this starting this fall, and I suspect that that period of time—the period of time required for this assessment will be in the order of 6 months.

Mr. Brown. Well, as a matter of principle, the process of evaluating a new program of this sort becomes extremely important to Members of Congress as something we should do with more programs, actually. The process that you use to accomplish that, I think is going to be significant in terms of evaluating the overall contribution.

Now, as you say, we did not intend that NASA become an eleemosynary institution here just to pass off money. We expect this to benefit NASA. But we also expect it to benefit the small business community and the overall process of innovation in American industrial society. And those are also goals of NASA.

Let's not contradict you, am I correct?

Mr. Johnson. That's correct. We've had several, I have had several presidents of small businesses volunteer to me that as a result of their SBIR programs awards with NASA, interest has developed in other parts of the private sector on those products that they are concerned with, even if they're not exactly the same thing that NASA is interested in.

A couple of small businesses told me that their continued existence has depended not on the funds that we provided, but rather on the product lines that they are developing. So we're certain that there is a considerable benefit to the private sector as well being in this, but it's just that we have not a completely good handle on it.

Mr. **Brown**. Well, I assure you that we'll be interested in seeing this documented. Anecdotal or survey type of information with regard to this should be a part of the evaluation process, in my opinion, because it will be useful to us.

This is a subject we'd like to explore further, but in the interest of time I'm going to excuse you gentlemen now so that we can go on to our last panel when we get back from this roll call.

Mr. **Ritter**. Mr. Chairman, could I just interject a quick question on the——

Mr. **Brown**. By all means. If you want to miss the roll call, go ahead.

Mr. **Ritter**. Those of us who are runners——[Laughter.]

What about the 10-year sunset possibility? There was some interest in that in some of the other committees. What would your opinion be on such a sunset provision?

Mr. **Johnson**. I think I missed a couple of words in your question. I know it has to do with our opinion about the sunset, but for a given period?

Mr. **Ritter**. For 10 years, yes. I'm sorry. What about the proposal that is being made by some for a 10-year sunset provision? What would your opinion be on that?

Mr. **Johnson**. Well, from my own view, 10 years is sure a lot better than nothing. And although our agency has not come to any firm conclusion on the complete elimination or repeal of this at this point, ten years would be certainly a great enough period to make a fairly competent assessment of the impact of the program.

Dr. **Decker**. I would agree with that comment. A 10-year sunset provision might be considered a more cautious approach. It would certainly provide adequate time for a really solid assessment of this kind of a program.

Dr. **Senich**. I would agree, sir. Our experience has shown that we've been fairly successful. However, it takes that 7 to 10 or plus years of experience that other agencies don't have yet.

Mr. **Ritter**. Well, I think we can get out on the track.

Mr. **Brown**. Thank you very much, gentlemen. We'll excuse you with the usual provision that if we need further information we'll ask you in writing, and our last panel will be called as soon as we return from the vote.

[Recess taken.]

Mr. **Brown**. The subcommittee will come to order. Our last panel this morning includes Mr. Richard Shane, Assistant Administrator of SBA; Ms. Ann Eskesen, representing Small Business United, Innovation Development Institute; Ms. Gwen Pritchard, legislative representative for the National Federation of Independent Business; and Dr. John Sherman, vice president of the Association of American Medical Colleges.

We're very happy to have the input from all of you on this, and we'll start with Mr. Shane.

STATEMENT OF RICHARD J. SHANE, ASSISTANT ADMINISTRATOR, SMALL BUSINESS ADMINISTRATION

Mr. SHANE. Thank you, Mr. Chairman. In the interest of time we'd like to summarize our statement, if we might.

Mr. BROWN. Your full statement will appear in the record, Mr. Shane.

Mr. SHANE. Thank you. Mr. Chairman, it is assuredly a pleasure to appear before you and the subcommittee today to express the administration's thoughts concerning the progress to date and the proposed reauthorization of the Small Business Innovation Development Act.

The implementation and development of the Small Business Innovation Development Act is of mutual gratification in that it has achieved all but one of the intended purposes of the legislation. The program success recorded to date are due to the mutual efforts of the administration, the Small Business Administration, the participating agencies, and the Congress.

The President signed into law the Small Business Innovation Development Act of 1982, and at that time he expressed his support for the Small Business Innovation Development Act when he said:

> Small business is a tonic for what ails this country. By passing and signing this act, we're showing our resolve to unleash this most innovative sector. The Small Business Innovation Development Act recognizes that we in government must work in partnership with small business to ensure that technologies and processes are readily transferred to commercial application.

The Small Business Innovation Research Program is well into its fourth year of performance. The SBA has analyzed fiscal year 1985 participating agency data. The data once again conclusively indicates a sound SBIR program. SBA monitoring and reviews strive to balance the interrelationships between proposals received, dollars expended, technical value, and commercialization.

During fiscal year 1985, the participating agencies received 9,090 proposals and made 1,395 phase I and 406 phase II awards. On a program cumulative basis, this totals to 25,859 proposals, 3,080 phase I awards and 744 phase II awards.

It is clear that the number of proposals received is more than adequate and the percent of proposals received to awards is highly competitive in a high technology procurement environment. Equally important is the opinion of the agencies that the technical quality of the innovation remains high.

During fiscal year 1985, the agencies awarded $199 million in SBIR funding agreements. On a program cumulative basis the program has now awarded in excess of $355 million. The awards have gone to 47 States and the District of Columbia and cover all areas of high technology.

We are extremely pleased that the innovations are covering the full spectrum of sciences in a general distribution and no single area dominates. I feel that this bodes well for the future of American technology in the 1990's and the potential dividends for the country are most promising.

In fiscal year 1985, the SBA began the operation of its commercialization matching system, which links SBIR awardees with potential sources of capital. CMS was developed to support a basic aim of the SBIR program; the conversion of R&D results into commercial applications and products through the use of non-Federal sources of capital. Both SBIR awardees and direct sources of capital are eligible to use the computer search capabilities of CMS to receive information about one another.

CMS has a keyword search capability to aid in the identifying of the SBIR awardees for potential sources of capital. Every word in the title, abstract, commercial applications, and keyword sections of the technical abstract is indexed.

The data base presently contains information on over 3,200 SBIR projects and 520 sources of capital. To date, CMS has been used by 325 SBIR awardees and 110 large corporations and 70 venture capitalists.

While the SBIR program is not without minor problems, it can clearly be stated at this point that the implementation, agency administration and technical direction have gone exceptionally well. Small high technology companies are beginning to develop the innovations that we all anticipated they would.

There is no lack of proposed innovative ideas, the quality is high, and the participating agencies have difficult final technical award decisions.

The first group of phase II awardees completed their work this spring. While we are all very enthusiastic about the results, we do not have the depth of quantitative data to make an estimate of commercial potential of the innovations. Because this information is not yet available and the current authorization runs until October 1988, the administration has not proposed reauthorization of the act.

However, the prospect for a successful commercialization phase looks favorable and we recognize that it will take several years to acquire and quantify information on commercialization. Therefore, we would not object to an extension of the sunset date of the act or a reauthorization to permit an orderly operation of the program while the data on phase III are being collected and evaluated.

Along with this, we also await the General Accounting Office report concerning the judgment of departments and agencies as to the effect of the act on the Federal research programs.

Mr. Chairman, I'd like to reiterate the administration's total and continued support of the Small Business Innovation Development Act, and I would like to close by stating once again our pleasure with the results of the SBIR program.

Mr. Chairman, this concludes my prepared statement at this time.

[The prepared statement of Mr. Shane follows:]

SBA
U.S. Small Business Administration
Washington, DC 20416

STATEMENT OF
RICHARD J. SHANE, ASSISTANT ADMINISTRATOR
OFFICE OF INNOVATION, RESEARCH & TECHNOLOGY
SMALL BUSINESS ADMINISTRATION
BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH
AND TECHNOLOGY
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
JULY 16, 1986

Mr. Chairman and Members of the Subcommittee:

It is assuredly a pleasure to appear before you and the subcommittee today to express the Administration's thoughts concerning the progress to date and proposed reauthorization of the Small Business Innovation Development Act of 1982 (P.L. 97-219).

The implementation and development of the Small Business Innovation Development Act is of mutual gratification in that it has achieved all but one of the intended purposes of the legislation. The program successes recorded to date are due to the mutual efforts of the Administration, The Small Business Administration, the participating agencies and the Congress.

THE PRESIDENT SIGNED INTO LAW THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT ON JULY 22, 1982. AT THAT TIME HE EXPRESSED HIS SUPPORT FOR THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT WHEN HE SAID "SMALL BUSINESS IS A TONIC FOR WHAT AILS THIS COUNTRY. BY PASSING AND SIGNING THIS ACT WE'RE SHOWING OUR RESOLVE TO UNLEASH THIS MOST INNOVATIVE SECTOR. THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT RECOGNIZES THAT WE IN GOVERNMENT MUST WORK IN PARTNERSHIP WITH SMALL BUSINESS TO ENSURE THAT TECHNOLOGIES AND PROCESSES ARE READILY TRANSFERRED TO COMMERCIAL APPLICATION."

IN ORDER TO MAKE HIS INTENTIONS CLEAR TO THE PARTICIPATING SMALL BUSINESS INNOVATION RESEARCH PROGRAM AGENCIES THE PRESIDENT, ON SEPTEMBER 16, 1982, SENT A PERSONAL MEMORANDUM TO THE HEADS OF SELECTED EXECUTIVE DEPARTMENTS AND AGENCIES WHEREIN HE STATED "I HOPE YOU WILL GIVE IMMEDIATE ATTENTION TO THE ESTABLISHMENT OF YOUR SMALL BUSINESS INNOVATION RESEARCH PROGRAM IN ORDER TO ENCOURAGE THE INITIATIVE OF THE PRIVATE SECTOR AND TO USE SMALL BUSINESS AS EFFECTIVELY AS POSSIBLE IN MEETING FEDERAL RESEARCH AND DEVELOPMENT OBJECTIVES."

THIS ADMINISTRATION'S SUPPORT WAS DEEMED IMPORTANT SO THAT THE PURPOSES OF THE ACT MIGHT BE ACHIEVED WITHIN THE SUNSET PROVISION TIME FRAME OF OCTOBER 1, 1988. THE STATED PURPOSES OF THE ACT ARE:

(1) TO STIMULATE TECHNOLOGICAL INNOVATION;

(2) TO USE SMALL BUSINESS TO MEET FEDERAL RESEARCH AND DEVELOPMENT NEEDS;

(3) TO FOSTER AND ENCOURAGE PARTICIPATION BY MINORITY AND DISADVANTAGED PERSONS IN TECHNOLOGICAL INNOVATION, AND

(4) TO INCREASE PRIVATE SECTOR COMMERCIALIZATION INNOVATIONS DERIVED FROM FEDERAL RESEARCH AND DEVELOPMENT.

THE SMALL BUSINESS INNOVATION RESEARCH PROGRAM IS WELL INTO ITS FOURTH YEAR OF PERFORMANCE. THE SBA HAS ANALYZED FISCAL YEAR 1985 PARTICIPATING AGENCY DATA. THE DATA ONCE AGAIN CONCLUSIVELY INDICATES A SOUND SBIR PROGRAM. SBA MONITORING AND REVIEWS STRIVE TO BALANCE THE INTER-RELATIONSHIP BETWEEN PROPOSALS RECEIVED, DOLLARS EXPENDED, TECHNICAL VALUE AND COMMERCIALIZATION.

DURING FISCAL YEAR 1985 THE PARTICIPATING AGENCIES RECEIVED 9090 PROPOSALS AND MADE 1,395 PHASE I AND 406 PHASE II AWARDS. ON A PROGRAM CUMULATIVE BASIS THIS TOTALS TO 25,859 PROPOSALS, 3080 PHASE I AWARDS AND 744 PHASE II AWARDS.

IT IS CLEAR THAT THE NUMBER OF PROPOSALS RECEIVED IS MORE THAN ADEQUATE AND THE PRECENTUM OF PROPOSALS RECEIVED TO AWARDS IS HIGHLY COMPETITIVE IN A HIGH TECHNOLOGY PROCUREMENT ENVIRONMENT. EQUALLY IMPORTANT IS THE OPINION OF THE AGENCIES THAT THE TECHNICAL QUALITY OF THE INNOVATION REMAINS HIGH.

DURING FISCAL YEAR 1985 THE AGENCIES AWARDED $199 MILLION IN SBIR FUNDING AGREEMENTS. ON A PROGRAM CUMULATIVE BASIS THE PROGRAM HAS NOW AWARDED IN EXCESS OF $355 MILLION DOLLARS. THE AWARDS HAVE GONE TO 47 STATES AND THE DISTRICT OF COLUMBIA AND COVERS ALL AREAS OF HIGH TECHNOLOGY.

THE TECHNICAL AWARD DISTRIBUTION TREND IS AS FOLLOWS:

TECHNOLOGY FIELD	PHASE I FY 1983-84-85 (% OF DOLLARS)	PHASE II FY 84-85 (% OF DOLLARS)
1. COMPUTER, INFORMATION AND ANALYSIS	19.6%	21.0%
2. ELECTRONICS	17.0%	18.0%
3. MATERIALS	18.0%	17.7%
4. MECHANICAL PERFORMANCE OF VEHICLES, WEAPONS AND FACILITIES	6.5%	6.0%

Technology Field	Phase I FY 1983-84-85 (% of Dollars)	Phase II FY 84-85 (% of Dollars)
5. Energy Conversion and use	11.4%	13.0%
6. Environment and Natural Resources	7.8%	8.0%
7. Life Sciences	19.7%	15.0%

WE ARE EXTREMELY PLEASED THAT THE INNOVATIONS ARE COVERING THE FULL SPECTRUM OF SCIENCES IN A GENERAL DISTRIBUTION AND NO SINGLE AREA DOMINATES. I FEEL THAT THIS BODES WELL FOR THE FUTURE OF AMERICAN TECHNOLOGY IN THE NINETEEN NINETIES AND THE POTENTIAL DIVIDENDS FOR THE COUNTRY ARE MOST PROMISING.

IN FISCAL YEAR 1985, SBA BEGAN THE OPERATION OF ITS COMMERCIALIZATION MATCHING SYSTEM (CMS) WHICH LINKS SBIR AWARDEES WITH POTENTIAL SOURCES OF CAPITAL (VENTURE CAPITALISTS, LARGER CORPORATIONS). CMS WAS DEVELOPED TO SUPPORT A BASIC AIM OF THE SBIR PROGRAM; THE CONVERSION OF R&D RESULTS INTO COMMERCIAL APPLICATIONS AND PRODUCTS THROUGH THE USE OF NON-FEDERAL SOURCES OF CAPITAL. BOTH SBIR AWARDEES AND DIRECT SOURCES OF CAPITAL ARE ELIGIBLE TO USE THE COMPUTER SEARCH CAPABILITIES OF CMS TO RECEIVE INFORMATION ABOUT ONE ANOTHER.

CMS ALSO HAS A KEYWORD SEARCH CAPABILITY TO AID IN IDENTIFYING THE SBIR AWARDEES FOR POTENTIAL SOURCES OF CAPITAL. EVERY WORD IN THE TITLE, ABSTRACT, COMMERCIAL APPLICATIONS, AND KEYWORD SECTIONS OF THE TECHNICAL ABSTRACT IS INDEXED.

THE DATA BASE PRESENTLY CONTAINS INFORMATION ON OVER 3,200 SBIR PROJECTS AND 520 SOURCES OF CAPITAL (EVENLY DIVIDED BETWEEN VENTURE CAPITAL FIRMS AND LARGE CORPORATIONS). TO DATE, CMS HAS BEEN USED BY 325 SBIR AWARDEES, 110 LARGE CORPORATIONS, AND 60 VENTURE CAPITAL COMPANIES. FOR THE MOST PART THE RESPONSE HAS BEEN ENTHUSIASTIC; MANY SOURCES OF CAPITAL HAVE ALREADY ASKED FOR ADDITIONAL SEARCHES.

WHILE THE SBIR IS NOT WITHOUT MINOR PROBLEMS IT CAN CLEARLY BE STATED AT THIS POINT THAT THE IMPLEMENTATION, AGENCY ADMINISTRATION AND TECHNICAL DIRECTION HAVE GONE EXCEPTIONALLY WELL. SMALL HIGH TECHNOLOGY COMPANIES ARE BEGINNING TO DEVELOP THE INNOVATIONS THAT WE ALL ANTICIPATED THEY WOULD.

THERE IS NO LACK OF PROPOSED INNOVATIVE IDEAS, THE QUALITY IS HIGH AND THE PARTICIPATING AGENCIES HAVE DIFFICULT FINAL TECHNICAL AWARD DECISIONS.

THE FIRST GROUP OF PHASE II AWARDEES COMPLETED THEIR WORK THIS SPRING. WHILE WE ARE ALL VERY ENTHUSIASTIC ABOUT THE RESULTS WE DO NOT HAVE THE DEPTH OF QUANTITATIVE DATA TO MAKE AN ESTIMATE OF COMMERCIAL POTENTIAL OF THE INNOVATIONS. BECAUSE THIS INFORMATION IS NOT YET AVAILABLE AND THE CURRENT AUTHORIZATION RUNS UNTIL OCTOBER 1988, THE ADMINISTRATION HAS NOT PROPOSED REAUTHORIZATION OF THE ACT. HOWEVER, THE PROSPECT FOR A SUCCESSFUL COMMERCIALIZATION PHASE LOOKS FAVORABLE AND WE RECOGNIZE THAT IT WILL TAKE SEVERAL YEARS TO ACQUIRE AND QUANTIFY INFORMATION ON COMMERCIALIZATION. THEREFORE, WE WOULD NOT OBJECT TO AN EXTENSION OF THE SUNSET DATE OF THE ACT OR A REAUTHORIZATION TO PERMIT AN ORDERLY OPERATION OF THE PROGRAM WHILE THE DATA ON PHASE III ARE BEING COLLECTED AND EVALUATED. ALONG WITH THIS WE ALSO AWAIT THE GENERAL ACCOUNTING OFFICE REPORT CONCERNING THE JUDGEMENT OF DEPARTMENTS AND AGENCIES AS TO THE EFFECT OF THE ACT ON FEDERAL RESEARCH PROGRAMS.

PUBLIC LAW 97-219 DIRECTS THE SMALL BUSINESS ADMINISTRATION AND THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY TO EACH INDEPENDENTLY SURVEY AND MONITOR THE SBIR PROGRAM AND REPORT THEIR FINDINGS TO THE HOUSE AND SENATE SMALL BUSINESS

COMMITTEES AT LEAST ANNUALLY. IN ADDITION, THE COMPTROLLER GENERAL WAS DIRECTED TO EVALUATE AND REPORT ON THE PROGRAM WITHIN FIVE YEARS. THE GAO HAS ELECTED TO PROVIDE A SERIES OF REPORTS AS THE PROGRAM PROGRESSES. THE FIRST REPORT WAS PUBLISHED ON OCTOBER 25, 1985, AND IS ENTITLED "IMPLEMENTING THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT -- THE FIRST 2 YEARS".

SINCE PROGRAM INCEPTION THE SBA HAS APPEARED BEFORE THE HOUSE SUBCOMMITTEE ON GENERAL OVERSIGHT AND THE ECONOMY IN APRIL AND NOVEMBER OF 1985 AND MAY OF 1986. THE SENATE SUBCOMMITTE ON INNOVATION AND TECHNOLOGY HAS HAD SBIR OVERSIGHT HEARINGS IN MARCH OF 1984 AND 1986.

MR. CHAIRMAN, I WOULD LIKE TO REITERATE THE ADMINISTRATION'S TOTAL AND CONTINUED SUPPORT OF THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT.

I WOULD LIKE TO CLOSE BY STATING ONCE AGAIN OUR PLEASURE WITH THE RESULTS OF THE SMALL BUSINESS INNOVATION DEVELOPMENT ACT.

MR. CHAIRMAN: THIS CONCLUDES MY PREPARED STATEMENT, I WILL BE PLEASED TO ANSWER ANY QUESTIONS THE SUBCOMMITTEE MAY HAVE.

SBA

Biography

U.S. Small Business Administration

RICHARD J. SHANE
ASSISTANT ADMINISTRATOR
OFFICE OF INNOVATION, RESEARCH AND TECHNOLOGY

Richard J. Shane, a native of Los Angeles, California, and a career Small Business Administration employee, in February 1985 was selected as the Assistant Administrator, in the Office of Innovation, Research and Technology of the U. S. Small Business Administration.

Prior to this selection, Shane had served as the Director of Research Acquisition Division, in the Office of Innovation, Research and Technology. He also had served in the Office of the SBA Administrator as Special Assistant to the Deputy Administator.

Shane has had 26 years experience in acquisition in both industry and the Federal Government. He joined SBA as a Contract Negotiator for the Los Angeles District Office in 1971, following 14 years in contract negotiation and administration management experience in the Aerospace industry.

In 1981, Shane was selected for the position of Assistant to the Deputy Administrator in the Office of the Administrator. The position entailed studies in acquisition and management, implementation of policies within the SBA and coordination with other Federal Government agencies.

In 1976, Shane was appointed National Manager of SBA's Subcontracting Assistance Program, with the responsibility for assisting small business firms in participating in subcontracting opportunities with major Federal Government prime contractors. In the course of these duties he was responsible for the implementation of PL 95-507 within the Subcontracting Assistance Program and participated with the Office of Federal Procurement Policy in the development of Policy Directives for the implementation of the law.

Shane obtained his bachelor of science degree from the University of Southern California and has done graduate work at both U.S.C. and UCLA. He has lectured in Acquisition at both universities.

Mr. Brown. I might say, Mr. Shane, that I'm particularly pleased with your testimony on behalf of the administration. I think, and you probably concur, that a large element in the very successful operation to date has been the enthusiastic support of the administration and the President. We get better results when the President and the Congress cooperate in a program than when we fight each other, quite obviously.

Mr. Cobey, I'm going to miss this vote and continue with the hearing, but if you wish to go and come back, why, that will be fine. I'll defer questions until we've heard the other testimony, Mr. Shane.

Ms. Eskesen.

STATEMENT OF ANN ESKESEN, REPRESENTING SMALL BUSINESS UNITED, INNOVATION DEVELOPMENT INSTITUTE

Ms. Eskesen. Thank you, Mr. Chairman, for the opportunity to testify on behalf of the reauthorization of the SBIR through H.R. 4260. I'm here today as a spokesman for Small Business United, the grassroots membership coalition of small business organizations from around the country.

When I sat before the full Science and Technology Committee over 4½ years ago, testifying on behalf of the SBIR program, there were a number of factors that we were clearly addressing at the time. Technical innovation was discussed and understood as the fundamental element underpinning the continued economic health and vitality of an industrialized economy. And it was pointed out and subsequently substantiated that in the last 40 years, more than 40 percent of economic growth in the United States has been as a direct consequence of technical innovation.

In the international scene, American firms on many fronts and in many fields were facing the full brunt of competition from other industrialized and industrializing nations. There was indication that the pace of technical innovation in this country was slowing. And in the process of discussing what was to be done about this, two or three factors were clearly emphasized.

First was the key role that the Federal Government, in the support of the conduct of research and development, played in encouraging technical innovation. The second was the well-developed track record of small firms as a primary source of that innovation and the convincing evidence being presented at the time that the small firms were having an increasingly difficult time accessing the research and development funds that were necessary to initiate that innovation process.

Though there were specific reservations and concerns expressed by some Members of this committee about the means by which it would be achieved, it was the final decision of many here and of Congress as a whole that the vehicle for that involvement of the small business community in the Federal R&D process would be the highly competitive program of SBIR.

The highly competitive environment, which defines SBIR, is not an element that should be lightly passed over. This is no set-aside in the sense of a narrowly defined population having been given protected and privileged access to resources. Rather, it is a situation, to use what I believe is the Washington term, of the playing field having been made level by a condition of open solicitation, such that all those who are judged qualified to compete had a chance to be considered. To quote from the commercial, SBIR offers opportunities, but no guarantees.

Under the skilled guidance and professional management of the program administrators in the participating agencies, the rapid implementation and progressive scale up of the SBIR effort has been effectively achieved and remarkably free of incident. This is not the place, and it has been done elsewhere, to give you a detailed analysis of SBIR awards and results. Though, as a point of reference for this committee, I have, on page three in my written testimony, given a bar graph indication of the progressive SBIR awards phase I and phase II, 1983 to 1985, and a systematic breakdown by State of all the members of the subcommittee and the States they represent.

The extent to which there has been a steady and, in some states, quite striking upsurge of SBIR successful participation is, however, worthy of comment. Geographic distribution is not and should not be a certain SBIR selection criteria. Neither is simply racking up the numbers any indicator of subsequent capacity to complete the innovation process.

However, while the sheer size and concentration of qualified firms in the State has rendered California a particularly strong numerical presence in the SBIR Program, companies in other States are making an increasingly important showing both in terms of increased numbers and, as discussed below, in their effective use of the program resources. And I have also in my prepared testimony given you pi charts and a breakout of the distribution and percentage of awards in the various States through the first 3 years of the program.

In an important sense, SBIR is no longer a Federal program, per se. Focusing on the job creation and economic development impact and potential of the small technology based firm, many States have put into place various forms of support for their SBIR qualified companies.

There's a clear correlation between the availability of that support, the quality of submissions from companies in those States, their subsequent capacity to achieve a good phase I, phase II conversion ratio, and, by whatever appropriate means, to bring that technology to use-condition.

Many in the SBIR qualified population, especially among the early multiple award winners, have well-developed technical and business skills. They would probably make it without this program and, like Congressman Zschau, for example, in his former business activities, they often don't need the technical support being provided to them by the States. Indeed, they very often serve as the role models and a source of that experience for others.

However, consistent with the current surge in entrepreneurship in this country and the pattern of substantial incorporation rates in technology based firms, as far as one can speak of a typical SBIR award, there are a number of characteristics.

They are small, often very small, very young, and most often headed by someone of considerable technical competence and skill, but limited business experience and background.

It is not an appropriate function in the administration of the SBIR Program to address that inexperience directly. But to the extent that the availability and potential of SBIR is causing that support to be provided, represents a not inconsequential, though indirect benefit, of the availability of the program.

SBIR is about new companies. Analysis of the fiscal year 1985 award listings by my firm, for example, indicated that 55.07 percent of the recipient firms were new to the SBIR Program. The SBA's analysis of the early awards of the SBIR Program indicated that a very high percentage of the companies involved were involved in the Federal procurement process for the first time.

Though with no scientific sample to substantiate our general observations, we would estimate that between 10 and 15 percent of the first-time awards are being used literally to open the doors of the company, with a comparable percentage being used as the resources for bringing onboard additional professional and technical employees. In fact, to grow the firm.

Though the increased resources of SBIR, the improved likelihood of the availability of follow on phase I funding and support and the enhanced technical credibility of the firm as an SBIR awardee, has attracted a greater number of larger small firms. Most of the firms in this program, a major percentage of them, are less than 5 years old, employ fewer than 100 people, the majority employing fewer than 10, most do not plan to substantial manufacturing capability and rapid growth, and even among those who do plan to that growth, over 90 percent, our evidence is, are presently planning to achieve market penetration of their developing technologies by engaging in some form of technology transfer or collaborative effort.

It can be argued that the emphasis in some of the participating agencies that the application for phase II consideration include documentation of follow on phase III support from the private sector has forced the issue. But the fact remains that perhaps the story in SBIR achievement is the extent to which the program involvement is characterized by collaborative relationships between small firms and those of other institutional affiliation.

To set this in context, addressing the pressures of international competition, shortening product and technology life cycles, the business climate of the eighties in this country has become one of an increasing emphasis on the strategic reliances, joint ventures and collaborative efforts of various kinds.

Running counter to a long business tradition of nondisclosure and a legal climate of antitrust, these joint ventures are demanding new techniques of management and commitment of resources which the evidence clearly suggests are not yet completely mastered. However, the pattern of their use is clearly established.

The collaborative efforts being undertaken in SBIR, therefore, are not unique, but they mirror what is happening elsewhere. The expressed concern that SBIR is siphoning funds away from other investigators can be countered with observation that a very high percentage of the awards involve the participation of the universities.

In the case, I believe, of the National Science Foundation, the indication is well over 50 percent. Specifically in the case of the National Science Foundation, the lead role formerly held by MIT in that collaborative effort perhaps significantly—when you look at the shift in where the awards are now being made, the indication now is that Carnegie Mellon and Cornell have assumed that lead position.

As part of my testimony, I have included—and they are to be delivered to you—letters of support from key officials at the University of Carnegie Mellon and the University of Pittsburgh, giving clear indication of their strong support of the SBIR Program and the important role it has played in the ability to enhance the economic development of technical activity within the Pittsburgh area.

There is consistent evidence of a growing number of relationships being established between small firms and large at all stages in the development process, but particularly at those—in those conditions where the resource capacity of the larger firm provides a considerable and mutual advantage, and often the specialist, high value-added capability of the small firm makes economic sense.

In the implementation of the SBIR Program, the emphasis has been, and must be, on the selection of projects at the highest scientific and technical competency, responsive to the defined needs of the agency. Mediocrity has no place in the conduct of science. As advocates of SBIR, we require that the highest standards of excellence in the conduct of federally funded research be required, whatever the institutional affiliation of the investigator.

The highly competitive conditions of the SBIR application process have served very well to ensure achievement and maintenance of quality in the projects which have been selected. As the program is being better understood, both by the applicant small firms and those who prepare the solicitation topics, there has been a steady and progressive improvement in the overall depth and quality in received submissions.

There is accumulating evidence that the SBIR projects are equal and, in some instances, better in quality than those which are being funded among the more traditional constituency serviced by those agencies.

While there is no evidence that the high standards of project submission, selection and award will not continue, I confess to a growing and developing concern about the continuing capacity of agency personnel to monitor as effectively as they must ongoing projects, particularly in the phase II effort.

As the scope and scale of the SBIR Program is increased, the resources available to program managers have not kept pace and are, indeed, now stretched to the absolute limits. Not to address this condition as part of the reauthorization effort would, I think, be a serious omission and which potentially would have adverse impact on the achieved standards of quality and excellence.

In consequence, all funds required to support SBIR administration and implementation have been allocated from the existing budget commitments of that agency. As the resource requirements of SBIR have increased with the expansion of the program to the present scale, the strains implicit in that arrangement have been considerable.

This cuckoo-like condition with SBIR clearly perceived as noncontributing administratively, at least, in a period of budget constraints and cutbacks, has probably been an unnecessary source of friction, particularly in the smaller agencies.

More critically, however, at this stage, addressing this problem offers the potential—or not addressing this problem offers the potential for inadequate monitoring of funded projects and/or deterioration in the availability and access to program support services.

As part of its consideration of the oversight function, therefore, which directly ties to the issue of maintaining quality in the program overall, I would recommend that this committee address this administrative funding question strengthening the agencies' capacities to self-police this program.

The integrity of this program will be maintained not by shifting or increasing oversight responsibility externally, but by ensuring that there is adequate available support to the agency personnel who are best qualified to do this job.

Specifically I would recommend a legislatively defined percentage with a dollar cap for each agency, and a recommendation of some of the types of activities that this might cover.

I'd like to conclude my testimony by addressing two quite separate but related issues concerning the timing factor; the period of time for which SBIR will be reauthorized, and the period of time during which that decision will be made.

The present SBIR Program is legislated to continue until the end of the fiscal year 1988. In fact, as we have heard, SBIR represents a 3-year funding commitment. On every selected phase I project, the potential is created for 2 additional years of phase II support.

Entirely appropriately, therefore, unless Congress specifically deems otherwise, in the very near future the agencies have, with the exception of the Department of Energy, I understand, almost entirely made contingency arrangements to discontinue the program as from this next set of solicitations—that is, no new phase I awards will be made after fiscal year 1987.

This will have, in fact, in my judgment, an impact of seriously creating a perceived lottery situation which would almost certainly dissuade some of the more qualified firms from active or extensive participation.

We recognize that the congressional agenda is very, very crowded right now, and I would urge this committee not to be one of those which are making consideration which will result in SBIR being one of those which are delayed and, therefore, unmade decisions in this Congress.

On one level, the intensity of activity and achievement in SBIR has been considerable in the number of awards that have been made, the fields that are being covered and the quality of work undertaken. In the larger scheme of things, however, we have hardly begun.

This early in the process we can offer little evidence of achieved technological breakthrough or of major business development. We can speak only of progress made toward defined objectives under the potential for greatness.

Industry and technology development analysts are almost universally agreed that in a technology-based product or process activity, the time period from initial concept through development and demonstration to achievement of a market condition is rarely less than 7 to 10 years.

In products which involve human impact use, specifically medical device and health science projects, which is such an important part of the SBIR Program, the evaluative and test procedures these often require extend those time lines out, often to 12 or 14 years.

We need the time to complete the process for firms in your States just now entering this important program to have the time to see the process through. That probably calculates to a period greater than or equivalent to that which we have already been given, allowing the 106th Congress to determine finally how well we did the job.

Thank you, sir.

Mr. WALGREN. Thank you. Next we'll hear from Gwen Pritchard.

[The prepared statement of Ms. Eskesen follows:]

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Swampscott, MA 01907-1595

Subcommittee on
Science, Research and Technology

U.S. House of Representatives
Committee on Science and Technology

Hearings on
H.R. 4260
Legislation to Continue the Small Business Innovation Research Program (SBIR)

Wednesday, 16 July, 1986

Prepared remarks of:

ANN ESKESEN, President
Innovation Development Institute, Swampscott, MA

Spokesperson:
Small Business United.

(617) 595-2920

First, may I thank you, Mr.Chairman, for the opportunity to testify in support of H.R. 4260 which will re-authorize the Small Business Innovation Research program (SBIR) beyond the presently legislated sunset date of September 30, 1988. My name is ANN ESKESEN. I am president of a small Massachusetts research and publishing firm, the Innovation Development Institute (**idi**) and managing editor of the nationally distributed newsletter **InKnowVation** which has become for many the leading source of information on effective use of the SBIR program. I was an elected delegate to the 1980 White House Conference on Small Business and am a delegate to that Conference again this Summer with specialty in the field of Innovation. I speak today as a member of Small Business United, the grassroots membership coalition of small business organizations from all around the country.

When I sat before the full Science and Technology Committee over four and a half years ago testifying in support of passage of what several months later became the enabling legislation for the SBIR program (PL 97-219), we were debating from several key assumptions:

- technological innovation - defined as the process of taking an idea for a new product/process through all the stages of research, development and demonstration into a use condition (in the commercial or federal marketplace) - was affirmed and understood as perhaps the fundamental element underpinning the continued economic health and vitality of an industrialized economy. Since WW II in the United States, for example, technological innovation - perhaps most effectively summarized in this context as *using what we know* - was judged by most experts as responsible for more than 40 percent of economic growth, with no other factor in that equation accounting even for double figures.
- in the international arena, American firms on many fronts and in many fields were facing (often not too successfully) the full brunt of competition from other industrialized and industrializing nations aggressively positioning for both our domestic and international markets.
- there was indication that the pace of technological innovation in this country was slowing and, with it, our capacity to compete in a great many fields basic to our economic vitality, and critical to our future development.

In analyzing the situation at the beginning of this decade to determine what needed to be done,

- the vital role in stimulation of technological innovation played by the federal government through support of high-risk research and development and through procurement was discussed and emphasized.
- the well developed track record by small firms and individuals was demonstrated, showing them to have been a prolific and cost effective source of successful innovation in the United States over the previous several decades and finally,
- convincing evidence was presented that, as the combined consequence of several factors, many highly qualified scientific and technical investigators employed in small firms in this country, already seriously constrained by the scale of the required commitment in their capacity to support the early stages of the innovation process from internal resources, had become progressively more restricted in their access to federal funds which would support that work and, thereby, limited in their capacity to contribute most effectively into the national knowledge base.

Though there were specific reservations and concerns expressed by some members on this committee about the means by which this would be achieved, it was the final decision of many here, and of the Congress as a whole, that as a proven, prolific and cost effective source of new ideas, new technologies, new jobs and new industries, more qualified small firms should be brought more extensively into the federal R&D procurement endeavor.

The vehicle for this enhanced involvement was legislated expansion to all the leading federal agencies which support extramural research - now eleven - of the program initially developed in the National Science Foundation and later adopted voluntarily by the Department of Defense (DESAT). Under this program - SBIR - in open competition against other small firms, qualified applicants submit proposals responsive to an extensive list of topics developed by agencies' technical personnel.

The highly competitive environment which defines SBIR is not an element that should be passed over without comment. This is no set-aside in the sense of a narrowly defined population having been given a protected access to resources. Rather, it is a situation in which - to use what I believe is the Washington parlance - the playing field having been made level (at least to an extent) by the circumstances of open solicitation, all those who judge themselves qualified have a chance to to be considered -- SBIR offering, to quote the commercial, "opportunities, but no guarantees".

As agency personnel and others have testified on several occasions previously, the number of received proposals in SBIR far exceeds - sometimes by a factor of ten or more - the number of awards to be made. Routinely across all the agencies, because of the limited funding levels which even this year's fully legislated 1.25 percent makes available, at least twice as many projects are highly rated by the technical reviewers and recommended for funding than there is money to support.

SBIR results 1983-86 - an overview

Under the skilled guidance and professional management of the program administrators in the participating agencies, the rapid implementation and progressive scale-up of the SBIR effort has been effectively achieved and remarkably free of incident. Over the first three years of the phased-in [1] program for which we have results to date [2] over 3230 Phase I projects have been selected for support in more than 1685 firms around the country. Out of the FY 86 SBIR budget of $306 million (idi estimates), a projected 1400-1500 new Phase I projects are expected this year. Depending upon the decision of this committee and this Congress (see discussion below) the number of new Phase I's expected to be made in FY 87 may range from 1000-1500.

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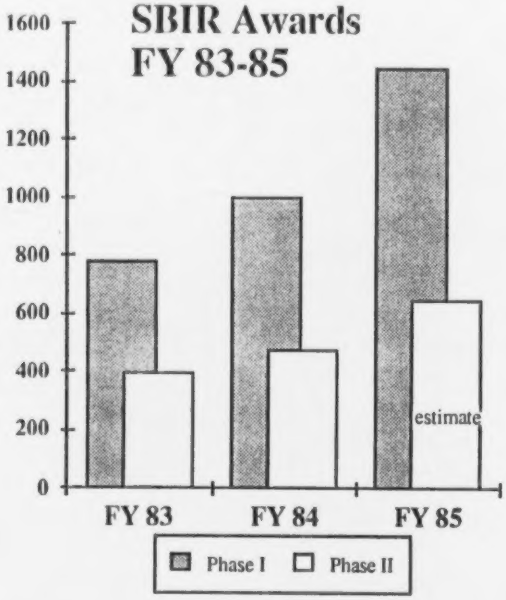
[1] Under the enabling legislation, the ten civilian agencies which exceed the $100 million in extramural R&D support had four years over which to phase-in to the full 1.25 percent required by the law. On a schedule of 0.2, 0.6, 1.0 and 1.25 percent, the SBIR program is fully implemented in those agencies during FY 86. The Department of Defense had five years over which to achieve SBIR phase-in. On a schedule of 0.1, 0.3, 0.5, 1.0 and 1.25 percent, the DOD program will be operational at the required 1.25 during FY 87.

[2] With the exception of the National Institutes of Health which offers three submission dates per year (next due date August 15), all the SBIR Phase I submissons for FY 86 have been received. As a group, DOE results were announced some weeks ago. Some individuals awardees have also been informed in DOD and NIH. The full listing of results in these and the other agencies is expected by the early Fall.

Across all the participating agencies some 396 projects initiated in FY 83 are just now completing Phase II [3]. A further 266 (plus an estimated 200 more) projects begun in FY 84 have been continued into the first stage of Phase II last year, and an anticipated 400-500 more Phase II awards (FY 84 and FY 85 initiated) are expected over the next several months. (See Figure I for summary of SBIR Phase I and Phase II Awards FY 83-85)

Figure 1



This is not the place or time to make a detailed analysis of SBIR awards and results -- though as a point of reference for the members of this sub-committee I have prepared charts for the states they represent indicating totals of Phase I awards received to date, and the numbers of participating companies broken out by rates of retention and recruitment [4]. (See Figure II)

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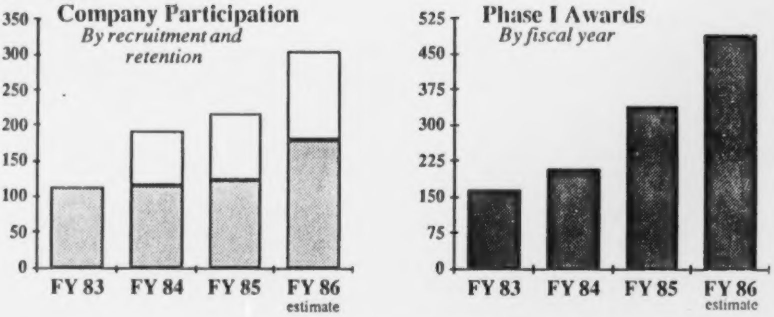
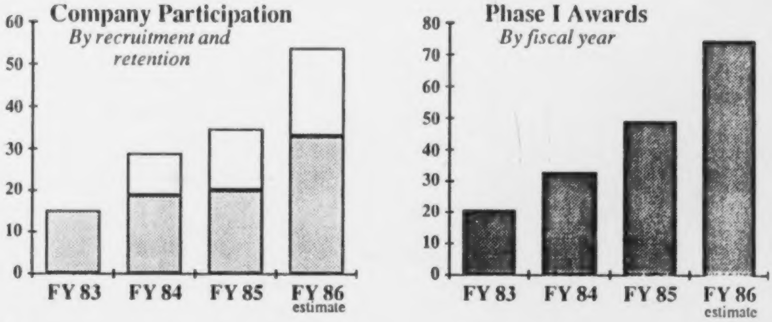
[3] Though at **idi** we track all SBIR projects by reference to the year in which the Phase I work was initiated, in several of the agencies (principally DOD, NIH and NSF) by the choice of the firm and/ or force of circumstances, decision on Phase II may be held over to the next or subsequent fiscal year. NIH, for example, may grant an awardee a no-cost extension on Phase I. Further, NIH permits a firm to withhold on submission for Phase II consideration for up to three solicitation due dates (i.e. one year in NIH) after completion of the Phase I effort. This can have the effect of pushing out selection and announcement of continuance to Phase II of the project by up to two years.

Figure II

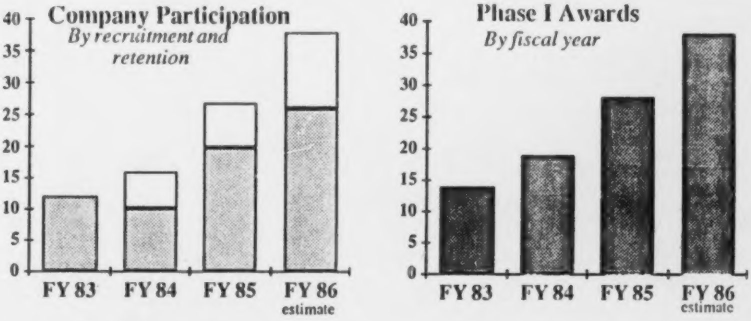
California



Colorado



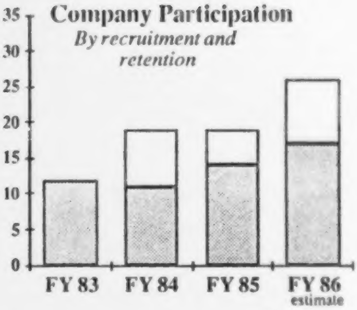
Illinois

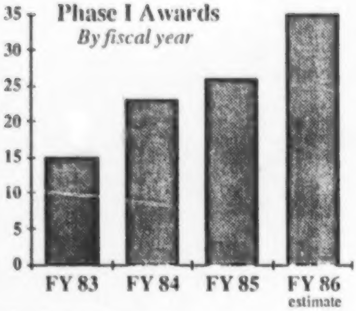


▨ *Newly recruited* ☐ *Retained with either Phase I or Phase II involvement*

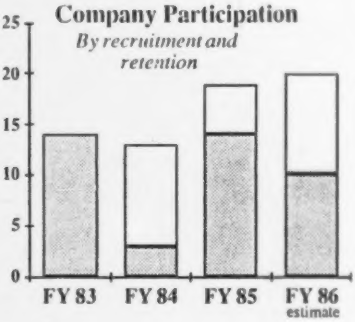
Figure II cont.

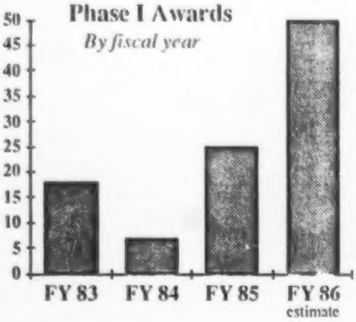
Michigan



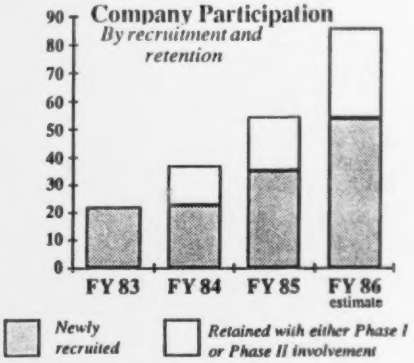


North Carolina





New York



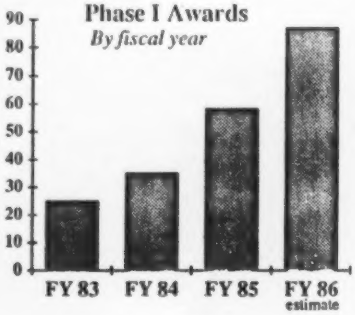
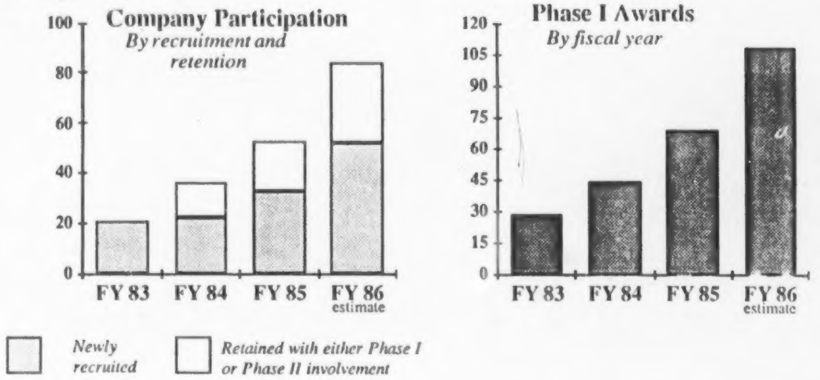


Figure II cont.

Pennsylvania



The extent to which there has been a steady, and in some states quite striking upsurge of SBIR successful participation is, however, worthy of comment. Geographic distribution has not been - and should not be - an SBIR selection criteria. Neither is simply racking-up-the-numbers any indicator of subsequent capacity to complete the innovation process. However, while the sheer size and concentration of qualified firms in the state has rendered for California a particularly strong numerical presense in the SBIR program, companies in other states are making an increasingly important showing both by increased numbers of awards and, as discussed below, by their effective use of program resources. As indicated in the pie-chart and accompanying table below listing the leading SBIR states 1983-85, after California and Massachusetts, Maryland, Virginia, Pennsylvania and New York are becoming contenders with several other states not far behind. (Figure III; Table 1)

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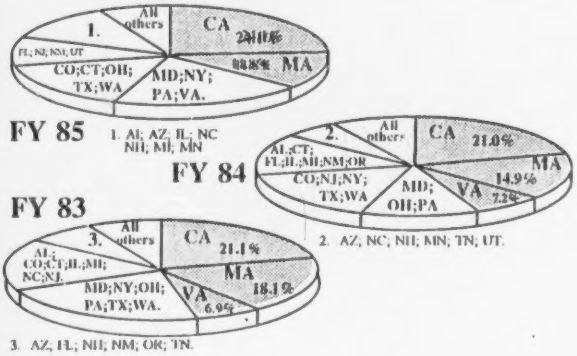
[4] In the early days of the SBIR program considerable emphasis - appropriately - has been laid upon getting-out-the-word, upon broadening the base of companies active in the program. As noted above, that effort in large part has been successful. However, in effective program usage from the point of view of the firm, of the host state and of the agencies, there is considerable evidence that quality is achieved and maintained by continued involvement by the receiving firm in the SBIR program. This translates into Phase II conversion and/ or, especially in the less experienced firm at the outset, into additional Phase I awards. As funded projects (and firms) mature, more of them will 'graduate' through the SBIR process. For some of the firms involved in the early NSF program, that process has already begun. At the outset, however, successful projects - those which will complete the innovation process - are more likely to be those which assume, and have been planned to, a longer term commitment.

SBIR Phase I Awards Figure III

(by year, state and percent)



In an important sense, SBIR is no longer a federal program *per se*. Focusing to the job creation and economic development impact and potential of the small technology-based firm [5], many states are putting into place varying forms of support for their SBIR qualified companies. There is clear indication that where this is happening - particularly with the provision of appropriate information access and skills development - the quality of submissions from companies in those states, their subsequent capacity to achieve a good Phase I-Phase II conversion ratio and, by what ever appropriate means, to bring the developed technology to use-condition is much improved.

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[5] A Brookings Institute study of employment growth in the period 1976-80 has shown that technology-based firms as a population (including large and small) increased their total employment by over 19 percent, as compared with 12 percent in low- and no-technology manufacturing and service businesses. In the 1985 Science Indicators volume published by the National Science Board, for example, it is noted that, in 1980, industries based in technology accounted for 22 percent of all manufacturing and business service employment. In that same source it is also reported that 42 percent of growth in manufacturing employment and 26 percent of employment gains from formation of new manufacturing establishments were in the industries based in technology.

In data developed for the Brookings study, it has been shown that while small firms in 1980 were only 24 percent of employment in technology-based industries, as a group they dominated employment growth. From 1976-80, with technology-based companies overall growing at a 3.5 percent rate, small firms in this category registered an 8.3 percent rate. Perhaps more significantly with reference to SBIR awardees, among that population of small, technology-based firms with fewer than 100 employees, employment growth has been at a rate in excess of 10 percent a year.

There is some indication that the steepness of this growth curve has lessened. As a source of employment growth in 1982, technology-based firms showed a decline which has continued into the past two years. Nevertheless, it is apparant that much of the vibrancy in the economy in some states correlates with the extent to which the prevailing climate has fostered and supported the formation and growth of the small, technology based firm.

Table 1

Leading SBIR Participating States
Ranked by # of Phase I awards
(FY 85 reference point)

	FY 85		FY 84		FY 83	
	Awards	% whole	Awards	% whole	Awards	% whole
California	319	24.1	211	21.0	166	21.1
Massachusetts	156	11.8	150	15.0	142	18.1
Maryland	79	6.0	42	4.2	36	4.6
Virginia	71	5.4	72	7.1	54	6.9
Pennsylvania	63	4.8	44	4.4	36	4.6
New York	51	3.9	34	3.4	25	3.2
Colorado	45	3.4	33	3.3	19	2.4
Ohio	43	3.3	41	4.1	30	3.8
Connecticut	41	3.1	25	2.5	19	2.4
Washington	41	3.1	33	3.3	31	3.9
Texas	39	3.0	35	3.5	27	3.4
New Mexico	35	2.6	16	1.6	10	1.3
New Jersey	32	2.4	31	3.1	15	1.9
Florida	30	2.3	18	1.8	11	1.4
Utah	29	2.2	13	1.3	16	2.0
N Carolina	23	1.7	7	0.7	18	2.3
Illinois	23	1.7	19	2.9	14	1.8
Michigan	23	1.7	23	2.3	15	1.9
Minnesota	23	1.7	12	1.2	6	0.8
New Hampshire	21	1.6	8	0.8	9	1.1
Alabama	20	1.5	20	2.0	15	1.9
Arizona	19	1.4	7	0.7	8	1.0

New firms: broadening the federal-industrial base

Many in the SBIR-qualified population, especially among the early, multiple award winners [6], have well developed technical and business skills. They would probably make it without this program and, like Congressman Zchau, for example, in his former business activities, they often do not need the technical support being provided in the states. Indeed, they are often serve as role models and a source of that experience development in others.

However, consistent with the current surge in entrepreneurship and pattern of substantial incorporation rates in technology-based firms [7] as far as one can speak of a 'typical' SBIR awardee, it is a very small, and generally very young firm, most often headed/founded by someone of considerable technical competence and skill but limited in business experience and background. It is not an appropriate function in administration of the SBIR program to address that inexperience directly, but to the extent that the availability and potential of SBIR is causing that support to be provided to the firms involved, that represents a not inconsequential, though indirect benefit derived from the program.

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[6] It is characteristics of effective SBIR program usage that a small firm will remain involved in the program from one year to the next (often for the duration of the developing technology) and, depending primarily on the size of the firm, will make application for several awards, often from more than one agency. This is an entirely appropriate use of the program as a resource to support projects that are broader in scope than can be addressed by a single award and/or which may address several related, but separate, applications. Properly managed, this form of use directly addresses, even in the smallest of firms, the identified problem of the Phase I-Phase II funding lag on any one selected project.

[7] Between 1976-80, for example, a Brookings Institute study has shown that the net number of technology-based establishments formed nationally in the period was four times that of non-technology-based. *"High Technology and Employment Growth: Considerations of Firm Size, 1976-80"* Candee S. Harris, The Brookings Institution, 1984 and unpublished tabulations.

However, consistent with the current surge in entrepreneurship and pattern of substantial incorporation rates in technology-based firms [7] as far as one can speak of a 'typical' SBIR awardee, it is a very small, and generally very young firm, most often headed/founded by someone of considerable technical competence and skill but limited in business experience and background. It is not an appropriate function in administration of the SBIR program to address that inexperience directly, but to the extent that the availability and potential of SBIR is causing that support to be provided to the firms involved, that represents a not inconsequential, though indirect benefit derived from the program.

SBIR is about new companies.

- analysis of the FY 85 award listing by **idi**, for example, indicated that 55.07 percent of recipient firms were new to the SBIR program. (See Figure IV)

- SBA's analysis of the early awardees suggested that probably more than 80 percent had no previous federal procurement experience. Though we have not taken a national sample, those findings are broadly consistent with **idi**'s determination that though many awardees have previously worked on federally funded projects in various capacities, management of the paperwork relative to those projects has usually been someone else's responsibility. These firms often need some guidance and assistance in meeting the federal reporting and paperwork requirements which come, partiuclarly with Phase II responsibility. However, as noted in testimony before other Congressional Committees, agency personell have found among these firms much new and well-qualified talent on which to draw in the regular federal procurement process

Figure IV

FY 85 Company Numbers
New - Old Distribution

Agency	New	Old	% New
DOD	171	187	47.77
NIH	217	108	66.77
NASA	56	68	45.16
DOE	40	48	45.45
DOT	20	9	68.96
EPA	16	4	80.00
DoEd	9	3	75.00
NRC	6	4	60.00
DOC	0	7	0.00
DOI	2	0	100.00
Totals	537[1]	438	55.07

NSF and USDA data not available.

1. This by-agency new firm count does not provide a separate accounting for multiple awardee new firms with awards in more than one agency in FY 85.

- though again with no scientific sample to substantiate our general observations, we would estimate that between 12-15 percent of first-time awards are being used to open the door of the firm, with a comparable percentage of firms using the award(s) as the resource to support bringing on board additional professional and technical employees i.e. to grow the firm.

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[7] Between 1976-80, for example, a Brookings Institute study has shown that the net number of technology-based establishments formed nationally in the period was four times that of non-technology-based. *"High Technology and Employment Growth: Considerations of Firm Size, 1976-80"* Candee S. Harris, The Brookings Institution, 1984 and unpublished tabulations.

- though the increased resources of SBIR, the improved likelihood of the availability of follow-on Phase I support and the enhanced technical credibility [8] of the firm as an SBIR awardee has attracted a greater number of more substantial (i.e. older and larger) small firms into the program

- the major percentage of awardees still are firms less than five years old
- few employ more than 100 people
- the majority employ fewer than ten
- most do not plan to substantial manufacturing capability and rapid growth and
- even among those targeting to significant growth using the institutional forms of investing represented by formal venture capital and public offerings here and overseas, **over 90 percent of SBIR awardees presently plan the achieve market penetration of their developing technologies by engaging in some form of technology transfer** - licensing, joint venture or other mode of collaborative effort.

Collaborative efforts

It can be argued that the emphasis in some of the participating agencies that application for Phase II consideration include documented evidence of follow-on funding (Phase III) commitment by an independent third party has forced the issue. The fact remains, however, that perhaps THE STORY in SBIR is the extent to which program involvement is characterized by collaborative relationships between the small firms and those of other institutional affiliation.

To set this in context, addressing the pressures of international competition and shortening product and technology life-cycles, the busines climate of the eighties has become that of increasing emphasis on strategic alliances, joint ventures and collaborative efforts of various kinds between large corporate entities often previously in direct competition with each other. Running counter to a long business tradition of non-disclosure and a legal climate of anti-trust, these joint ventures are demanding new techniques of management and commitment of resources which the evidence is are not readily mastered. However, the pattern of their use is clearly being established.

The collaborative efforts being undertaken in SBIR, therefore, are not unique to the extent that they mirror what is happening elsewhere. However, with expressed concerns that SBIR is syphoning funds away from other investigators, it should be noted that

- across all the agencies, but particularly in those with primary emphasis to the 'R' of the R&D continum, to the mutual benefit of all parties, the major percentage of successful SBIR projects include a consulting relationship, most commonly involving someone with an academic affiliation. Perhaps significantly, given the note above concerning the strong progress in SBIR by firms in Pennsylvania and New York, in NSF at least, the lead role formerly held by MIT in that capacity is now shifted to Carnegie Mellon and to Cornell, but now includes most of the major research institutions around the country.

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[8] Consistently identified by firms involved in SBIR on a continuing basis as perhaps a primary benefit of their participation, fully equal to that of the received funding, is the technical stamp-of-approval, as it were, which being an awardee brings them. Their having survived what is understood to have been the intensively competitive conditions of open-solicitation at Phase I and continuance into Phase II is proving to be an important confirmation to potential investors and/or those in the larger corporate community with whom relations are being developed of the technical competency of the smaller firm.

- there is consistent evidence of a growing number of relationships being established between small firms and large at all stages in the development process but particularly in those circumstances where the resource capacity of the larger firm provides an considerable, mutual advantage, and the often specialist, high value-added capability of the smaller firm makes economic sense.

Consistent with the experience of the federal procurement officers noted above, the large firms are finding among SBIR awardees skills and qualities of technical competence on which it is to their mutual benefit to draw.

Emphasis to quality – the oversight function

In implementation of the SBIR program, the emphasis has been - as it must be - on selection of those projects of highest scientific and technical competency, responsive to the defined needs of the funding agency. As I stressed in my testimony before this committee over four years ago, mediocrity has no place in the conduct of science and, as advocates of SBIR, we require the highest standards of excellence in the conduct of federally funded research - whatever the institutional affiliation of the investigator.

The highly competitive conditions of the SBIR application process referenced earlier has served very well to ensure achievement and maintenance of quality in the projects which have been selected. As the program has become better understood - by both the applicant small firms and those who prepare the solicitation topics [9] - there has been a steady improvement in the overall depth in quality of received submissions. There is accumulating evidence (in some agencies supported by written testimony and documentation) that SBIR projects funded projects are entirely consistent, and some instances better, in quality with those supported in the more traditional constituency serviced by that agency. The expressed concerns by some on this committee that small firms could not do the job should at this point have been been allayed.

While there is no evidence that these high standards of project submission, selection and award will not continue, I must confess to a developing concern about the continuing capacity of agency personnel to monitor as effectively as they must ongoing projects, particularly at the more substantial effort of Phase II. As the scope and scale of the SBIR program has increased, the resources available to program administrators have not kept pace and indeed are now stretched to the limits. Not to address this condition as re-authorization is enacted would, I think, be an serious omission which potentially could have adverse impact on the achieved standards of quality and excellence.

Assuming what, in my judgement, was an inappropriate interpretation of the Congressional intent, in the original implementation effort it was determined that no percentage of the funds allocated to SBIR could be used for administrative purposes. In consequence, all funds required to support SBIR implementation and administration have been to this point allocated from the existing budget commitments of that agency. As the resource requirements of SBIR have increased with the expansion of the program to its present scale, the strains implicit in that arrangement have been considerable.

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[9] There seems to be a direct correlation between the specificity and quality of the prepared topic description and the quality of received proposals. Not able in a broadly scoped-out topic to determine the criteria of evaluation and selection, the likely priorities of the evaluating officer and, critically, the probable competition within that category, quality firms generally indicate their unwillingness to submit proposals in these type of circumstances. A quality - and therefore funded project - is most likely to be one in which the best competencies of the submitting firm are matched to the defined needs of the technical officer and receiving agency.

This 'cuckoo-like' condition with SBIR clearly perceived non-contributing (administratively) in a period of budget contraints and cut-backs has probably been an unnecessary source of friction particularly in the smaller agencies. More critically, however, at this stage, it offers the potential for inadequate monitoring of funded projects and/or deterioration in the availability and access to program support services.

As part of its consideration of the Oversight function which ties directly to the issue of maintaining quality in the program overall, therefore, **I would recommend that this Committee address this administrative funding question strengthening the agencies' capacities to self-police this program.** The integrity of this program will be maintained not by shifting or increasing oversight responsibility externally, but by ensuring that there is adequate, available support to agency personnel.

Specifically, I would recommend a legislatively defined percentage with a dollar cap for each agency and the compilation of a sample listing of the functions and tasks which might be covered by that amount. These might include, among others which can be discussed,

- preparation, publication and distribution of the program solicitation document and of the published abstracts of funded projects
- development of, and participation in, appropriate seminars and conferences focused to pre-award informational briefings and awardee firm development
- on-site visits by technical officers as well as audit personnel
- a capacity, as appropriate, to fund third-party evaluative studies of specific aspects of SBIR program usage and developments.

To conclude my testimony, I would like to address two quite separate but related points concerning the timing of re-authorization

1. the period of time for which the SBIR program will be re-authorized
   and
2. the period of time over which that decision will be made.

SBIR Re-authorization by this Congress

The present SBIR program is legislated to continue until the end of Fiscal Year 88. In fact, however, as structured, SBIR represents a three-year funding commitment. On every selected Phase I project, the potential is created for two additional years of Phase II support.

Entirely appropriately, therefore, with the exception of the Department of Energy, unless Congress specifically legislates otherwise, most of the program administrators plan to have FY 87 (the next Phase I solicitation cycle) be the last - that the surge of interest and participation engendered in this program around the country will be tempered by only one more opportunity to be funded. It is also likely that, to ensure adequate resources to support the more substantial needs of existing Phase II projects that, bucking the trend of previous years, the number of new Phase I's, will be significantly reduced creating a perceived lottery situation [10] which will almost certainly dissuade some of the more qualified firms from active or extensive participation.

As noted in the Wall Street Journal and the other major dailies this week, always crowded at this stage in the process, the Congressional calendar this year is bursting at the seams. In the pressure of these final weeks, many important decisions will not be made. I would make strong appeal to you today that SBIR Re-authorization - a popular and contributing program - not be one of those delayed, and therefore unmade, decisions.

Period of Continuance

On one level, the intensity of activity and level of achievement in SBIR has been considerable. By almost any criteria of evaluation the SBIR is resounding success. Almost 1700 firms around the country have been in receipt of awards. The quality of sponsored work is of a standard entirely comparable to that of any other research populations. In many fields, significant advances towards the development and application of technology are being made. The agencies are buying quality work at a good and fair price while at the same time effectively investing in the small firm, and the country's future. Awardee firms are leveraging their SBIR federal dollars at a rate in excess of 5:1 — for each dollar of federal support, collectively the SBIR-active population are accessing more than five dollars of private sector funds in the form of venture capital, public offerings, revenue flows from licensing, joint venture and collaborative efforts to support their continued growth and operations.

Collaborative efforts are being supported and actively encouraged between small firms and the universities -- more than 70 percent of funded SBIR projects involve an academic consultant. Relationships are being established between small firms and large -- a mirror of the collaborative condition that is an increasingly common element in the global environment of modern business. New jobs are being created and international markets accessed.

In the larger scheme of things, however, we have hardly begun. This early in the process we can offer little evidence of any achieved technological breakthrough or major business development. We can speak only of progress made towards defined objectives and of potential for greatness.

Industry and technology development analysts will almost universally agree that in technology-based product/process activity the time period between initial concept through development and demonstration to achievement of any significant market penetration is rarely less than seven to ten years. In products which involve human impact-use - specifically medical device and health science projects, which is so important a part of the SBIR program - the evaluative and test procedures which those so often requires may take those timelines in this country out to twelve to fourteen years.

We need the time to complete that process; for firms in your states just now entering this important program to have time to see the process through. That probably calculates to a period equivalent to that orginally granted by the 97th Congress enabling what will be the 106th Congress to determine finally how well we did the job!

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[10] In the normal scheme of things, for an academic or non-profit affiliated investigator, for example, the expectation is that, of quality submission one of three (and commonly, one of two) projects will be funded. Though particularly well qualified individual firms have on occasion achieved these rates of return in SBIR, as noted above, the range of submission to award overall has rarely fallen below five or six to one, will routinely be ten to one and has been known to go far higher. By reducing the number of topics and more specifically refining the published content, the agencies have generally done a good job of keeping the ratio of submission to award at acceptable levels. Cut-back on the number of awards to be made as would be required unless reauthorization is forthcoming shortly, will almost certainly reduce the credibility of the SBIR program among many of the most qualified firms.

STATEMENT OF GWEN PRITCHARD, LEGISLATIVE REPRESENTATIVE, NATIONAL FEDERATION OF INDEPENDENT BUSINESS, INC.

Ms. PRITCHARD. Good morning. I'm here today to commend the committee for its timely oversight hearings on the Small Business Innovation Development Act, and to advise you of NFIB's unqualified support for the program.

As most of you know, NFIB has over a half million members and we want to thank you for the opportunity to testify on permanent reauthorization of the act. In fact, we welcome the opportunity for this kind of oversight of such a successful program.

Some of you will remember we were very active and involved in the original legislation that enacted the SBIR. In 1981, when we began that debate, none of us realized the size of our opposition. It is rare, indeed, for a bill of any type to involve congressional consideration by eight committees.

Our adversaries included big business, federally funded laboratories, universities, and even some Government agencies. Again and again, we ran into the inherent unwillingness of individuals and entities to acknowledge the contribution small business was making to the innovation of this country. And, again and again, we responded with the facts and outlined the merits of our position.

One by one, our adversaries were convinced that small firms could do the job without jeopardizing the quality or quantity of the research and that the Government served to benefit from the small business participation.

Looking back on the repeated successes of this program throughout the Government, I think we can all agree that our hard-fought efforts were justified. We are pleased to see the participation of the agencies and the enthusiastic support, and are delighted to note that over 40 States have developed similar programs. And, indeed, I don't know if anyone has brought up that the programs are also being modeled in Europe and other countries.

These hearings and those of the House Small Business Committee have already reinforced what we already knew; the program works, and the participating Government agencies want to see it continued.

There is an expressed need for this formalized mechanism to maintain the cooperative effort between Government agencies and small business. In fact, most of the 50 White House conference delegations have agreed and feel that the program should not only be permanently reauthorized, but expanded.

The successes of this program are many and the biggest winner has proven to be the Federal Government. Our Government has direct access to the most innovative sector of the country's economy. Because the pool of available scientific and technological expertise continues to increase, the Government is able to upgrade its own technological processes. The program has also had a direct positive impact on maintaining the U.S. preeminent position in technology development.

In addition, conversion of research into new products and services has increased due to the SBIR, with both the marketplace and the Government benefiting.

I'd like to take a moment to tell you that one of the reasons that I'm participating in this hearing is because an NFIB member from Houston was unable to attend because he had to go to a meeting with some physicians at Texas A&M on marketing a program that he was able to develop through SBIR.

I think it's an appropriate point in my testimony to interject his letter and to speak to some comments that were made in the submitted statement that Dr. Sherman will present later, expressing a concern that the contributions of this program may be—are they trivial to the functions and missions of the Departments of Health, in particular, NIH and those programs.

[The letter referred to follows:]

CARDIONICS, INC., 15502 Old Galveston Rd., #220, Webster, Texas 77598, Telephone: (713) 488-5901 Telex 4993776 CARDX UI

New Address:
1100 Hercules, Suite 210
Houston, Texas 77058

July 15, 1986

Cardionics

Ms. Gwen Pritchard
National Federation of Independent Business
600 Maryland Ave., S.W., Suite 700
Washington, D.C. 20024

Dear Gwen:

This is a follow up to our recent discussions regarding the Small Business Innovation Research Grant program which we understand in being reviewed by Congress for renewal.

We strongly support this program. Small business not only employs the majority of people in this country, but is also is responsible for much of the innovation. The problem that faces almost every entrepreneur is lack of capitalization. The SBIR program eases that problem.

The biomedical instrumentation business is characterized by a large number of small firms. Most of the innovation in this field has come from small business. Many well known products as the disposable syringe, I.V. solutions and artificial kidney machines were originally were started by small business.

Our company has developed a noninvasive means to measure cardiac output in patients in intensive care and has received a phase I grant in the amount of $50,000. to conduct advanced clinical trials of this product. The traditional method of measuring cardiac output is to place a catheter in the heart when the patient is in the cath lab. Our device, and others like it, provide the physician with an alternative method which is accurate and repeatable, less costly to the patient and elimates the risk of catherization.

We do not have the resources to properly test this device without outside capital such as is provided by the SBIR program.

Traditional sources of capital are very difficult for most entrepreneurs to obtain. Banks generally loan funds on a collateralized basis and venture capitalists normally look for opportunities which produce large rewards in a very short time. The medical business is quite conservative by nature and is also regulated by the FDA. Therefore, except in obvious market situations, it tends to move at a slower pace than many venture capitalists would like to see.

Denver Office: 3601 S. Clarkson; Suite 404, Englewood, CO 80110, Telephone (303) 759-1892

The SBIR program, therefore, is one of the few and best opportunities for an entrepreneur to receive funding in a competitive process to develop an idea which may have significant economic and public value. We believe it is counter-productive to the nation to reduce or eliminate the SBIR.

You have our best wishes in your efforts to have the SBIR program continued.

Sincerely,

CARDIONICS, INC.

Keith Johnson
General Manager

KHJ:noe

Ms. Pritchard. Mr. Johnson, from Cardionics in Houston, has a biomedical instrumentation business, and he said it's characterized by a large number of small firms. Most of the innovation in this field has come from small business. Many well-known products, as the disposable syringe, the I.V. solutions, artificial kidney machines, were first innovated by small firms.

His company has developed a non-evasive means to measure cardiac output in patients in intensive care units, and has received a phase I grant from SBIR in the amount of $50,000 to conduct advanced clinical trials of this product. The traditional method of measuring cardiac output is to place a catheter in the heart when the patient is in the cath lab. His device and others like it provide the physician with an alternative method, which is accurate and repeatable and less costly to the patient, and eliminates the risk of this process, catheterization, as some of us unfortunately are too well aware of.

We do not have the resources, he says, to properly test this device without outside capital, such as provided by the SBIR Program. Traditional sources of capital are very difficult for most entrepreneurs to obtain. Banks generally loan funds on a collateralized basis and venture capitalists normally look for opportunities which produce large rewards in a very short time.

The medical business is quite conservative by nature, and is also regulated by the FDA. Therefore, except in obvious market situations, it tends to move at a slower pace than many venture capitalists would like to see.

The SBIR Program, therefore, is one of the few and best opportunities for an entrepreneur to receive funding in a competitive process to develop an idea which may have significant economic and public value.

Mr. Johnson says he believes it is counterproductive to the Nation to reduce or eliminate the program.

NFIB thinks that one of the reasons why this particular program is such a winner is that every time an item is a solicitation is in keeping with an agency's own programatic goals. I think this is very important. It is not a Federal assistance program, as we've unfortunately come to know some. The awards of funds under the SBIR are made on a competitive basis. It is encouraging to note that the abuses associated with other set-aside programs have been successfully avoided in the SBIR.

There is no doubt that one of the reasons that is the case is the excellent job done by the Small Business Administration and Dick Shane. They have done an excellent job in oversight and in coordinating the efforts of all the participating agencies.

The Government's contracting officers agree that the technical quality of the proposals they are receiving under the SBIR are significantly improved because of the SBA's efforts. In addition, SBA staff should be credited for making this program workable for interested small businesses.

In fact, today I think it was the NSF spokesman indicated the proposals were of the highest quality. This has to do with oversight, we feel, by not only the House and Senate Small Business Committees, the rest of the congressional committees and by SBA.

Probably one of the biggest benefits of the program has to do with the special contribution we feel small business has been making to our economy over the last decade. It has been noted frequently that the majority of all new jobs during the period have been generated by small firms, especially for firms in R&D fields.

There has been a doubling of employees in most businesses involved in the SBIR program. Again, the Nation's economy benefits, revenue generating businesses are expanding, and taxpaying employees are increasing.

During the hearings in the House Small Business Committee, the Department of Commerce testified and spoke to this issue, and I'd like to repeat some of their testimony because I think it speaks to the fact that there are a lot of other agencies interested in this program.

They testified at that point that it is of great importance to Commerce, not only as an agency R&D sponsor, but in a broader role of creating incentives and removing barriers to swift introduction of new U.S. products and processes in the commercial marketplace.

The Department went on to say:

> There is a growing understanding that the commercial marketplace is now global and the health of the United States economy can no longer be addressed in isolation. In this context, one foreign competitor after another has learned that control of the new technology results in control of the marketplace, even beyond the parameters of technology. Foreign competitors have already become the primary suppliers of new technologies which have displaced older technologies previously supplied by the United States.
>
> Notwithstanding the losses of these markets and jobs we are not standing still. While small businesses are languishing in many parts of the world—where high technology small businesses are virtually unknown—the United States is experiencing a small business explosion.
>
> We are creating hundreds of thousands of new small businesses a year. About 10 percent of these are high tech companies which then create at least 5 to 15 support jobs in their other companies. Economic value from such support functions constitute approximately 50 percent of our GNP, where they serve as a stabilizing flywheel.
>
> SBIR is an important part of this equation because these start-up high technology companies are most vulnerable when their discoveries are still being developed and risk capital is hard to find.

I might also quote that some of the other people that we've talked to—specific instances, a company in New Hampshire—received a phase I award in 1982 of $35,000. They've since been able to attain followup funding of $5.5 million. They started with 4 employees and now they have 110.

Another company in Lennox, MA, indicated that they started with 33 employees and now have 135. It has raised $40 million based on the initial genetics research conducted under the SBIR award. The company was the first to identify the genetic marker for cystic fibrosis.

NFIB feels strongly that the continuity of the Small Business Innovation Act is essential. At a time when deficit reduction is on everyone's mind, it would prove irresponsible, we feel, to cut back in any way a program that has proved itself to be so efficient and cost effective.

As a result of the $1.8 million SBA spends on SBIR, small businesses receive $480 million in Federal R&D awards. While this act does not expire until 1988, Government agencies must begin now their budgeting efforts for the upcoming years. It is appropriate that we, too, begin the process of permanently reauthorizing the SBIR.

In conclusion I'd like to say that we feel SBIR is no longer an experiment. It should be permanently reauthorized, and NFIB endorses legislation to accomplish this goal now.

[The prepared statement of Ms. Pritchard follows:]

NFIB® National Federation
of Independent Business
The Guardian of Small Business®

STATEMENT OF

GWEN PRITCHARD

FOR

THE NATIONAL FEDERATION OF INDEPENDENT BUSINESS

Before: Subcommittee on Science, Research and Technology of the House Committee on Science and Technology

Subject: H.R. 4260, providing for permanent authorization of the Small Business Innovation Research (SBIR) Program

Date: July 16, 1986

Mr. Chairman, the National Federation of Independent Business, on behalf of its over half million members, appreciates this opportunity to testify today on a permanent authorization of the Small Business Innovation Research Act.

When NFIB first presented Congressional testimony in 1981 on the then proposed (and controversial) SBIR legislation, we supported a program which promised "to be a significant benefit, both to the small business community and to our nation as a whole." We were not without our critics: the enacting legislation involved consideration by seven Congressional committees.

Government Relations and Research Office
600 Maryland S.W., Ste. 700
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202/554-9000

Mr. Chairman, today we welcome the opportunity to say that in every aspect, the SBIR program has proved to be a benefit not only to the small business community, but to the nation.

Today, 12 government agencies with extramural research and development budgets of over $100 million have established SBIR programs by setting aside 1.25 percent of that money for small businesses. Another 7 agencies with R&D budgets in excess of $20 million have established similar small business goals for such funding. Also, over 30 states have developed similar or complementary programs, and several foreign countries are using our SBIR program as a model.

The successes of the SBIR program are many. Everyone's a winner, including the federal government. Our government has direct access to the most innovative sector of the country's economy -- small business. Because the pool of available scientific and technological expertise continues to increase, the government is able to upgrade its own technological processes.

Consider NASA. Mr. Harry W. Johnson, Director of Small Business Innovation Research office, testified to the House Small Business Committee:

> NASA has found that a great number of new and attractive approaches to problems and opportunities identified in the Program Solicitation have been offered by a large number of

> innovative small firms. Many of these ideas had not previously been volunteered to NASA by those firms, and possibly would never have been offered in the normal course of events. The SBIR opportunity and stimulous made it possible for them to reach NASA's attention and to be funded...
>
> One conclusion, based on three years of experience on the program, is that the SBIR Phase I - Phase II approach and program management philosophy, have provided a very cost-effective means for exploring new ideas rather quickly. The rapid response capability of our SBIR firms, and their generally high motivation and skill levels, have proved to be genuine assets in our overall program. SBIR contract efforts are viewed as integral and important elements of the overall NASA R&D program...Among the SBIR projects, are the development of new analytical methods, designs, software, and hardware for direct use by NASA in our total R&D and operational program activity. (Statement of Mr. Harry W. Johnson, NASA Director, Small Business Innovation Research Office, before the House Small Business Subcommittee on General Oversight and the Economy, May 8, 1986, p. 2 and 3).

Another winner is our economy. The majority of all new jobs during the past decade have been generated by small firms, especially firms in the R&D field. As illustration, the National Science Foundation noted in their recent House Small Business Committee testimony several outstanding SBIR participants.

Collaborative Research, Inc. had 33 employees in relatively old facilities at the time of its Phase I award. Today, the firm has 135 employees and large new laboratories in Lexington, Massachusetts. It has raised over $40 million based on the initial genetics research conducted under their SBIR award. The company was the first to identify the genetic marker for Cystic Fibrosis.

Native Plants, Inc. of Salt Lake City, Utah had 40 employees when it received its initial SBIR funding. The company now has 250 employees, outstanding new laboratories, a research park adjacent to the University of Utah campus, and is a world leader in the field of plant genetics.

Verax Corporation of Hanover, New Hampshire received a Phase I award of $35,000 in 1982. Verax has since obtained follow-on funding of more than $3.5 million. The corporation now has a new laboratory, is working closely with MIT, as well as Dartmouth and Rutgers scientists, and is already selling products to major biological and pharmaceutical firms. Verax grew quickly from 4 to 110 employees and spun off two separately financed scientific instrument firms. These spin-offs are direct bi-products of the NSF and NIH SBIR projects. Verax now has 75 employees after the two spin-offs.

As noted, program results to date indicate the outstanding rewards in private follow-on funding commitments for SBIR projects. These commitments provide the incentive for conversion of SBIR research into technological innovation and commercialization. Clearly, the SBIR program has a direct, positive impact on maintaining the United States' preeminent position in technological development and the conversion of research into new products and services.

The Department of Commerce testified that the SBIR program "is of great importance to Commerce, not only as an agency R&D sponsor, but in our broader role of creating incentives and removing barriers to swift introduction of new U.S. products and processes and the commercial marketplace." The Department went on to say:

> There is a growing understanding that the commercial marketplace is now global and the health of the United States economy can no longer be addressed in isolation. In this context one foreign competitor after another has learned that control of a new technology results in control of the marketplace even beyond the parameters of the technology. Foreign competitors have already become the primary suppliers of new technologies which have displaced older technologies previously supplied by the United States.
>
> Notwithstanding the losses of these markets and jobs we are not standing still. While small businesses are languishing in many parts of the world -- where high technology small businesses are virtually unknown -- the United States is experiencing a small business explosion. We are creating hundreds of thousands of new small businesses a year. About 10% of these are high technology companies which then create 5 - 15 support jobs in other companies. Economic value from such support functions constitute approximately 50% of our GNP, where they serve as a stabilizing flywheel. SBIR is an important part of this equation because these start-up high technology companies are most vulnerable when their discoveries are still being developed and risk capital is hard to find. (Statement of Norman J. Latker, Director, Federal Technology Management Policy Division, OPTI, U. S. Department of Commerce, before the House Small Business Subcommittee on General Oversight and the Economy, May 15, 1986, p. 2 and 3).

In our 1981 Congressional testimony we stressed the role of innovation in creating "new products, processes and services that fuel productivity increases, resulting in significant increases in wealth per capita and a higher quality of life for our citizens."

In attaining the goal of a higher quality of life for our citizens, we can look specifically to two SBIR success stories initially funded through the Environmental Protection Agency.

Bend Research, Inc. in Oregon has successfully obtained private sector funding for the commercialization of a unique, cost-effective process to recover metal from hazardous waste sludges. They have established recovery techniques to convert some of the constituents of plating sludges into reusable or salable metal compounds, while at the same time reducing the volume of waste as well as making that waste non-hazardous. EPA testified that the Bend process can potentially eliminate the high-hazardous waste sludge disposal cost of $.7 to 2.8 billion per year for the electroplating and electronics industry.

PEI, Associates Inc. in Cincinnati, Ohio has discovered an on-site recycling approach to eliminate the problem of disposal of hazardous electric arc furnace dust. Dust emitted from arc furnaces at steel mills is normally captured by large bag houses and sent to controlled hazardous waste landfills. Prior attempts to recover the useful metals in the dust by recycling it to the furnaces have not been successful. PEI has used an inexpensive pelletizer system to agglomerate the dust into pea-sized pellets (greenballing). An experimental dust greenballing/recycling program at an actual steel mill, using electric arc furnaces, has shown the process to be cost-effective. The major advantage of this on-site greenballing recycling process is the elimination of the need to transport the dust to expensive, controlled hazardous waste disposal facilities charging upwards of $150 per ton.

In short, EPA testified that...

> examples of successes under our SBIR program appear to offer the potential of more cost-effective pollution control technology. Given the relatively short existence of the SBIR program, we are only beginning to see the results. However, indications are that the SBIR contribution could result in lower pollution emissions to the environment. (Statement of Roger S. Cortesi, Director, Office of Exploratory Research, Office of Research and Development, U. S. Environmental Protection Agency, before the House Small Business Subcommittee on General Oversight and the Economy, May 15, 1986, p. 8).

Mr. Chairman, NFIB believes one of the reasons the SBIR program is such a winner is that every item in a solicitation is in keeping with each individual agency's own programmatic goals. The SBIR is not a federal assistance award program. The awards under the SBIR program are made on a competitive basis and are of outstanding technical quality.

The Department of Energy testified that:

> Perhaps the most striking feature of the DOE SBIR program is the high technical quality of the projects supported. DOE technical staff involved in proposal review and selection, reports overwhelmingly that the weight of the technical contents of our SBIR projects, is fully comparable with that of projects supported by the Department of Energy outside of the SBIR. (Statement of Ryszard Gajewski, SBIR Program Manager, Department of Energy, before the House Small Business Subcommittee on General Oversight and the Economy, May 13, 1986, p. 1).

Further, the NSF testified that competition for awards is not just high, it is intense: "Typically, we can only fund 50% of the Phase I proposals recommended for awards. This attests to the high quality of the proposals and to the capability of the high-tech firms and the competition." (Statement of Richard J. Green, Assistant Director for Scientific, Technological and International Affairs, National Science Foundation, before the House Small Business Subcommittee on General Oversight and the Economy, May 8, 1986, p. 2).

Clearly, the SBIR program has proved its role in facilitating effective technology transfer, creating an important linkage between federal R&D and innovation by bringing together two essential component parts for success: the federal R&D dollar and small business, the most innovative sector of the economy.

Let me assure you, Mr. Chairman, the SBIR program has and does receive appropriate oversight. We can report that at the recent oversight hearings of the Small Business Committee, every participating agency testified to the success of the program and to their desire to see it continued. There is an expressed need for this formalized mechanism to maintain the cooperative effort between government agencies and small business.

NFIB feels strongly that continuity of the Small Business Innovation Development program is essential. At a time when deficit reduction is on everyone's mind, it would prove irresponsible to cut back in any way a program that has proved itself to be so efficient and cost-effective. While this act does not expire until 1988, government agencies must begin their budgeting and planning efforts now for the upcoming years. It is appropriate, then, that we begin the process of permanently authorizing the SBIR program.

In sum, the SBIR is funding research in key technology areas that are not only important to the federal government, but also to our nation's economy and its citizens. The program represents the Congress' recognition that small business R&D firms have an essential role to play in technological innovation. It is an opportunity for researchers with high-risk ideas from small firms with strong R&D capabilities to work effectively with federal agencies, then with universities, industries, and venture capital firms to bring these technologies to market fruition.

The SBIR is no longer an experiment. It should be permanently reauthorized, and NFIB endorses H.R. 4260 to accomplish this goal now.

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GWEN PRITCHARD

Legislative Representative
for the
NATIONAL FEDERATION OF INDEPENDENT BUSINESS

Ms. Pritchard has been a lobbyist for the National Federation of Independent Business for over six years. She is responsible for interpreting and presenting NFIB's position on a wide variety of small-business issues. These include the budget, procurement, banking, the SBA and regulatory reform.

In this capacity Ms. Pritchard is in direct liaison with 180 members of the House of Representatives and a dozen Senators. As a lobbyist for the nation's largest individual membership business organization, she is frequently called upon to participate in numerous coalition and other policy-making groups. She has direct input into NFIB's decision-making process in the areas of strategy and policy development and in this capacity, also serves as an advisor to NFIB's PAC.

Prior to joining NFIB, Ms. Pritchard was a Legislative Assistant on Capitol Hill for eight years. She monitors all legislation in the areas of government regulations, small business, banking, the budget, consumer affairs and procurement. She is an active member of Womne in Government Relations and recently served on the Board of Directors. Ms. Pritchard currently co-chairs the Congressional Relations Committee for WGR.

A native of upstate New York, Ms. Pritchard came to Washington to attend American University. She holds a B.A. degree from there and has earned credits toward a graduate degree in Legislative Affairs from George Washington University.

Mr. **Walgren**. Thank you very much for that testimony. You indicated at the end there $480 million from——

Ms. **Pritchard**. In other words, the cost to the SBA for administering the program itself, the SBA. And that figure is probably dated. I'm sure Mr. Shane could update it. That was a figure that we used—that was an old——

Mr. **Walgren**. That's the administrative costs to SBA compared to the total Federal money that goes into——

Ms. **Pritchard**. Yes; that's right.

Mr. **Walgren**. Thank you very much. And then, Dr. Sherman.

STATEMENT OF DR. JOHN F. SHERMAN, VICE PRESIDENT, ASSOCIATION OF AMERICAN MEDICAL COLLEGES

Dr. **Sherman**. Thank you, Mr. Chairman. We are grateful to you and your colleagues on the subcommittee for the opportunity to present the views of the Association of American Medical Colleges on this pending legislation. These views are also consonant with those of the Public Policy Committee of the American Society for Microbiology, and I was asked to make that known.

I perhaps should add at the outset that given the nature of the previous testimony today and the content of some parts of our statement, perhaps my appearance could be analogized to that of a skunk at a garden party. But I believe to be perfectly responsible we wish to lay before you some of the questions that our convictions have raised in the context of the review of making this authority permanent.

Since the association's major arena of interest is the research activity of the Department of Health and Human Services, and since that Department is outside the jurisdiction of the Committee on Science and Technology, the AAMC is doubly appreciative of this opportunity and will present its views in as general a perspective as possible.

The association, which is now over 100 years old, serves as the national voice for our Nation's 127 accredited medical schools and their students, more than 400 of the country's major teaching hospitals, and over 70 academic and professional societies whose members are heavily engaged in teaching, patient care and biomedical and behavioral research.

This Nation's academic medical centers collectively conduct more than 55 percent of federally supported health research and produce a high proportion of all of the new scientific and technical knowledge related to health. New knowledge is absolutely essential, as you know, for applied research and technical development to flourish, whether pursued in academia or in industry.

Mr. Chairman, this is not the first time the association has come before a congressional body to testify on this issue. In February of 1982, the association presented to the Subcommittee on Health and Environment of the Energy and Commerce Committee the reasons for its opposition to the legislation creating the SBIR program. I come before you today with many of the same concerns as were expressed at that time.

But, at the outset, it should be made unequivocally clear that the importance of innovation, as this term of art is used in the business community, is beyond dispute.

The commercial products of innovation research enhance our society's standard of living and the process of fabricating them contributes to the Nation's economic welfare and growth. Clearly it is in the Nation's self-interest to be second to none in the vigor of its innovative research activities.

Not clear, however, is the proper role of the Federal Government in encouraging innovation in the American free enterprise model that traditionally provides rich rewards to entrepreneurs whose confidence in their ideas make them willing to risk much to bring these novel ideas to the market.

Many practitioners hold that the essence of their commitment to entrepreneurship is its privacy and freedom from government intervention and so-called help. But in recent years American industry has come under an increasing competitive threat from, and in some instances lost its leadership on the cutting edge of technology to, foreign nations. Voices have been raised in advocacy of government assistance.

One point of view emphasizes that the most significant deterrent to innovation and innovation research is the dearth of venture capital. The modification of Federal tax statutes in the late 1970's dramatically expanded the availability of venture capital to, among other things, small business firms. And I would venture to say that the biotechnology industry, without the presence of this program, is a superb example of that expansion.

Thus, the provision of tax incentives, especially those designed to generate venture capital, is one possible role for government.

Government loan guarantees, with or without interest subsidies, is another mechanism for public sector encouragement of innovation in instances in which conventional commercial lenders would find inherent risk unacceptably high.

A third possibility, direct government loans, again with or without interest subsidies, are another mechanism for government intervention in the stimulation of innovation.

All of these are time honored processes well accepted in the business community. All place the entrepreneur at risk, but are compatible with great rewards when that risk pays off. All are well precedented mechanisms of government intervention into private sector activities and are viewed as sound public policy.

From the association's point of view, however, the SBIR, based on dedicating a fraction of extramural research budgets of Federal R&D agencies for the sole purpose of innovation research conducted by small businesses, is not sound public policy.

In the domain of concern of the AAMC—the Nation's biomedical and behavioral research effort to improve health, to extend useful biomedical and behavioral research effort and productive life spans, and to prevent premature deaths—a set-aside for small business firms is not only not necessary, but one can maintain that it has a corrupting and corrosive influence on an extraordinarily effective process for allocating Federal research funds. Let me expand on this assertion.

From extremely modest beginnings in the early decades of this century, the United States moved into a position of world leadership in medical research in the 1940's, and has maintained that preeminence in the four subsequent decades.

Our Nation's success in this great humanistic endeavor is to no small degree attributable to two factors: A historic commitment by the Federal Government to generous levels of support for science, especially basic research in the biomedical sciences; and a system which has been created for the selection of recipients of Federal funding; namely competition and award based on criteria of scientific and technical merit as determined by a jury of peers. In this context, why is the SBIR unnecessary and improper?

First, the necessity issue. The regular research grant programs of the HHS agencies, principally the NIH, are open to all applicants. An elaborate system of application review and evaluation has been in operation in essentially its present form since about 1945.

The Nation's most qualified scientists devote extensive bloc of their time and energies to helping the Federal agencies select, from among the welter of research proposals submitted, those whose intrinsic scientific and technical merit, and whose mission relevance harbinger the greatest promise for improving health and for favorably influencing disease processes.

Research proposals from all comers are rank ordered by merit and relevance, then funds are award to those adjudged most excellent by these criteria. The AAMC's argument is that 100 percent of that budget is potentially available to small business firms for high quality proposals.

If these organizations can generate high quality competitive proposals, the whole NIH world is its oyster. If it cannot generate proposals of that character, it ought not be allowed to lay claim to 1.25 percent, or any other percent, of the public money, and thereby divert such amounts from the woefully limited resources available for a large backlog of worthy regular research grant proposals that cannot be funded.

As you know, the competition for NIH research funds is fierce. A former director of that agency, Dr. James A. Shannon, once said, in arguing for stability of research funding, that the Government's role was to provide not stable support for individual investigators, but stability of opportunity to compete for funds.

That, it seems to the association, is the reality of the NIH system. On the average, new principal investigators remain in the system at least as principal investigators for only about 6 years, and less than 1 percent of those individuals remain in that capacity for a career; that is, for 30 years.

But unpleasant and anxiety provoking as this competition may be for individual scientists, it has been a crucible for refining science and has given the public patrons of science a remarkably high yield on their investment.

But consider the message conveyed to the agency managers of research programs by a statutory set-aside. The Congress is saying, in essence, spend *x* percent of the funds appropriated—no more, no less—on a specific genre of performers or on some other specified target, whether or not the proposals submitted are soundly conceived, technically competent, possess even the kernel of promise for a significantly useful product, bear any relevance to a discernible health objective. No matter what, spend this sequestered money on this target and on nothing else.

Given such a message, one that is undisguisably inherent in every statutory set-aside, agency managers must devise procedures to carry out the mandate as responsibly as possible. The result is the emergence, usually covertly, of a different and lesser standard of excellence, new and often artificial criteria of relevance and, in the final analysis, of expenditures of set-aside funds for projects that are less and often far less worthy than those funded in the regular program.

The only alternative available to agency managers is to fund only the meritorious projects and return the unspent balances to the treasury. Few relish explaining such an action to congressional committees that have enthusiastically supported the set-aside target.

These, then, are the grounds on which the AAMC in 1982 and 1986 believes that the small business set-aside is unnecessary and undesirable. A superbly sensitive and equitable system for allocating public funds to those research projects that hold greatest promise to solve medical and health problems is in place. Small business firms are eligible to participate.

The amount that these organizations can win under the existing system is limited not by any arbitrary percentage, but only by the extent to which they are able to formulate competitive research project applications.

Given this persuasion on the part of the association, it should come as no surprise to the committee that the proposal to make the set-aside permanent is distressing, pragmatically as well as in principle. As far as the latter is concerned, the AAMC's position flows clearly and directly from what has already been stated. But on the pragmatic grounds, the justification for making permanent the authority for an activity that had all of the attributes of an experimental program, including sunset, only 4 years ago we think is obscure.

Certainly there is no evidence extant to indicate the degree to which the program in medicine and health has so far achieved any of its stated objectives. As a matter of fact, at the NIH, the first group of grants funded under phase II will not be completed until this coming September. Thus, with so few phase II projects completed, and virtually no phase III efforts underway, there is simply no way in which the usefulness of the program can yet be assessed.

The association has heard from NIH that, at first, the quality of SBIR applicants was less than first rate, that is now improving; that the priority scores of applications from small business firms are now not too different from those in the regular program; and that some promising leads toward potentially useful products have emerged as a result of the program.

But the important point is that all of this information was provided and exists on only an anecdotal basis. Neither the reports each agency must file annually with the Small Business Administration, nor the study of the SBIR Program published recently by the General Accounting Office answer two essential questions: Has the research undertaken by approved SBIR applicants contributed in a nontrivial fashion to the overall mission of the DHHS? Has it met the statutory goals of the program?

Mr. Chairman, in order to answer these two questions, the association proposes that whatever action is taken on H.R. 4260 by this subcommittee and the Congress as a whole, a provision should be included that mandates a study to determine the following: The quality of the research supported by the SBIR Program compared to that supported under traditional mechanisms; the utility of the products that have been developed under the program; the extent to which the economic goals of the program have been met; and the impact of these investments on the preeminence of the United States in medical research as well as in biotechnology.

Although the programs of the Department of Health and Human Servcies, including those at the NIH, do not fall under the jurisdiction of this subcommittee, the association hopes that in your report you will recognize the serious public policy problems erected by set-asides in research programs, and the absence of need for such a set-aside in the domain of biomedical and behavorial research.

The association urges that at the very most the committee simply extend a limited authorization for the SBIR Program until enough experience accrues to permit a comprehensive study of how well it has achieved its objectives and of the effectiveness of the mechanism under which it has operated. The association suggests that the Office of Technology Assessment might be a suitable organization to carry out such a study.

Thank you very much for this opportunity, Mr. Chairman and colleagues. I'd be happy to respond to any questions.

[The prepared statement of Dr. Sherman follows:]

STATEMENT

OF THE

ASSOCIATION OF AMERICAN MEDICAL COLLEGES

on H.R. 4260

Legislation to Provide Continuing Authority
for the Small Business Innovation Development Act of 1982

Presented to
Subcommittee on Science, Research and Technology
Committee on Science and Technology
U.S. House of Representatives

July 16, 1986

Association of American Medical Colleges / One Dupont Circle, N.W. / Washington, D.C. 20036 / (202) 828-0525

Mr. Chairman and Members of the Committee:

I am grateful to the Science, Research and Technology Subcommittee for the opportunity to present the views of the Association of American Medical Colleges (AAMC) on H.R. 4260, legislation making permanent the authority of the "Small Business Innovation Development Act".

The AAMC, now over 100 years old, serves as the national voice for our nation's 127 accredited medical schools and their students, more than 400 of the major teaching hospitals, and over 70 academic and professional societies whose members are heavily engaged in teaching, patient care and biomedical and behavioral research. This nation's academic medical centers collectively conduct more than 55% of federally supported health research and produce a high proportion of all of the new scientific and technical knowledge related to health. New knowledge is absolutely essential for applied research and technical development to flourish, whether pursued in academia or in industry.

Since the Association's major arena of interest is the research activity of the Department of Health and Human Services (DHHS) and since that Department is outside the jurisdiction of the Committee on Science and Technology, the AAMC is doubly appreciative, and will present its views in as general a perspective as possible.

Mr. Chairman, this is not the first time the Association has come before a Congressional body to testify on this issue. In February of 1982, the AAMC presented to the Subcommittee on Health and the Environment of the Energy and Commerce Committee the reasons for its opposition to the legislation creating the SBIR program. I come before you today with many of the same concerns as were expressed in 1982.

But at the outset, it should be unequivocally stated that the importance of innovation, as this term of art is used in the business community, is beyond dispute.

The commercial products of innovation research enhance our society's standard of living and the process of fabricating them contributes to the nation's economic welfare and growth. Clearly, it is in the nation's self interest to be second to none in the vigor of its innovative research activities. Not clear, however, is the proper role of the federal government in encouraging innovation in the American free enterprise model that traditionally provides rich rewards to entrepreneurs whose confidence in their ideas make them willing to risk much to bring these novel ideas to the market.

Many practitioners hold that the essence of their commitment to entrepreneurship is its privacy and freedom from government intervention and "help". But in recent years, as American industry has come under an increasingly competitive threat from, and in some instances lost its leadership on the cutting edge of technology to, foreign nations, voices have been raised in advocacy of government assistance.

- One point of view emphasizes that the most significant deterrent to innovation and innovation research is the dearth of venture capital. The modification of federal tax statutes in the late 1970's dramatically expanded the availability of venture capital to, inter alia, small business firms. Thus, the provision of tax incentives, especially those designed to generate venture capital, is one possible role for government.
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instances in which conventional commercial lenders would find the inherent risk unacceptably high.

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All of these are time honored processes well accepted in the business community. All place the entrepreneur at risk but are compatible with great rewards when the risk pays off. All are well precedented mechanisms of government intervention into private sector activities and are viewed as sound public policy.

From the Association's point of view however, the SBIR, based on dedicating a fraction of extramural research budgets of federal R&D agencies for the sole purpose of innovation research conducted by small business firms is not sound public policy. In the domain of concern of the AAMC -- the nation's biomedical and behavioral research effort to improve health, to extend useful and productive life spans, and to prevent premature deaths -- a set-aside for small business firms is not only not necessary but it has a corrupting and corrosive influence on an extraordinarily effective process for allocating federal research funds. Let me expand on this assertion.

From extremely modest beginnings in the early decades of this century, the United States moved into a world leadership role in medical research in the 1940's and has maintained that preeminence in the subsequent four decades. Our nation's success in this great humanistic endeavor is to no small degree attributable to two factors: an historic commitment by the Federal Government to generous levels of support for science, especially basic research in the biomedical sciences; and a system which has been created for the selection of recipients of federal funding, namely, competition and award based on criteria of scientific and technical merit as determined by a jury of peers. In this context, why is the SBIR unnecessary and improper?

First, the necessity issue. The regular research grant programs of the HHS agencies, principally the NIH, are open to all applicants. An elaborate system of application review and evaluation has been in operation in essentially its present form since about 1945. The nations most qualified scientists devote extensive blocs of their time and energies to helping the federal agencies select, from among the welter of research proposals submitted, those whose intrinsic scientific and technical merit and whose mission relevance harbinger the greatest promise for improving health and for favorably influencing disease processes. Research proposals from all comers are rank-ordered by merit and relevance; then funds are awarded to those adjudged most excellent by these criteria. The AAMC's argument is that 100% of the budget is potentially available to small business firms for high quality proposals. If these organizations can generate high quality competitive proposals, the whole NIH world is its oyster; if it cannot generate proposals of that character, it ought not be allowed to lay claim to 1.25% or any other percent of the public money, and thereby divert such amounts from the woefully limited resources available for a large backlog of worthy regular research grant proposals.

As you know, the competition for NIH research funds is fierce. A former director of that agency, Dr. James A. Shannon, once said, in arguing for stability of research funding, that the government's role was to provide, not stable support for individual investigators, but stability of opportunity to compete for funds. That, it seems to the Association, is the reality of the NIH system. On the average, new principal investigators (PI's), remain in the system, at least as P.I.'s, for only about 6 years and less than 1% of PI's remain in that capacity for a cereer, i.e. for 30 years. But unpleasant and anxiety provoking as this competition may be for individual scientists, it has been a crucible for refining science and has given the public patrons of science a remarkably high yield on their investment.

But consider the message conveyed to the agency managers of research programs by a statutory set-aside. The Congress is saying, in essence: spend X percent of the funds appropriated -- no more, no less -- on a specific genre of performers -- or on some other specified target -- whether or not the proposals submitted are soundly conceived, technically competent, possess even the kernel of promise for a significantly useful product, bear any relevance to any discernable health objective. No matter what, spend this sequestered money on this target and on nothing else! Given such a message -- one that is undisguisably inherent in every statutory set-aside -- agency managers must devise procedures to carry out the mandate as responsibly as possible. The result is the emergence, usually covertly, of a different and lesser standard of excellence, of new and often artifical criteria of relevance, and, in the final analysis, of expenditures of set-aside funds for projects that are less, and often far less, worthy than those funded in the regular program. The only alternative available to agency managers is to fund only the meritorious projects and to return unspent balances to the Treasury; few relish explaining such an action to Congressional Committees that have enthusiastically supported the set-aside target.

These, then, are the grounds on which the AAMC in 1982 and 1986 believes the small business set-aside is unnecessary and undesirable. A superbly sensitive and equitable system for allocating public funds to those research projects that hold greatest promise to solve medical and health problems is in place. Small business firms are eligible to participate. The amount that these organizations can win under the existing system is limited not by any arbitrary percentage but only by the extent to which they are able to formulate competitive research project applications.

Given this persuasion on the part of the Association, it should come as no surprise to the Committee that the proposal to make the set-aside permanent is distressing, pragmatically as well as in principle. As far as the latter is concerned, the AAMC's position flows clearly and directly from what has already been stated. But on the pragmatic grounds, the justification for making permanent the authority for an activity that had all of the attributes of an experimental program, including sunset, only four years ago is obscure. Certainly there is no evidence extant to indicate the degree to which the program in medicine and health has so far achieved any of its stated objectives. As a matter of fact, at the National Institutes of Health, the first group of grants funded under Phase II will not be completed until this coming September. Thus, with so few Phase II projects completed and virtually no Phase III efforts under way, there is simply no way in which the usefulness of the program can yet be assessed.

The Association has heard from NIH: that, at first, the quality of SBIR applicants was less than first-rate, but that now is improving; that the priority scores of applications from small business firms are now not too different from those in the regular program; and that some promising leads toward potentially useful products have emerged as a result of the program. But the important point is that all this information was provided and exists on only an anecdotal basis. Neither the reports each agency must file annually with the Small Business Administration nor the the study of the SBIR program published recently by the General Accounting Office answer two essential questions: has the research undertaken by approved SBIR applicants contributed in a non-trivial fashion to the overall mission of the DHHS and has it met the statutory goals of the program?

Mr. Chairman, in order to answer these two questions, the AAMC proposes that, whatever action is taken on H.R. 4260 by this Subcommittee and the Congress as a whole, a provision be included that mandates a study to determine: the quality of the research supported by the SBIR program, compared to that supported under traditional mechanisms; the utility of the products that have been developed under the program; the extent to which the economic goals of the program have been met; and the impact of these investments on the preeminence of the United States in medical research as well as in biotechnology.

Although the programs of the DHHS, including those at the National Institutes of Health do not fall under the jurisdiction of this Subcommittee, the Association hopes that in your report you will recognize the serious public policy problems erected by set-asides in research programs, and the absence of need for such a set-aside in the domain of biomedical and behavioral research. The Association urges that at the very most, the Committee simply extend a limited authorization for the SBIR program until enough experience accrues to permit a comprehensive study of how well it has achieved its objectives and of the effectiveness of the mechanism under which it has operated. The Association suggests the Office of Technology Assessment might be a suitable organization to carry out such a study.

Thank you very much for this opportunity. I would be happy to respond to any questions that my presentation might have raised.

Mr. Walgren. Thank you, Dr. Sherman, very much. Mr. Brown?

Mr. Brown. Dr. Sherman, I was a little disturbed that this hearing might have been a little unbalanced because of the large number of supporters of this legislation and only you as an opponent, but I think you've done an excellent job and perhaps that's the reason there's only one of you invited, that you've done so well in stating the arguments against it.

I think we all recognize that there are defects in a program of this sort, and I would like to personally indicate that I could wholeheartedly support the recommendations that you've made that would mandate a study to actually assess the value of the program in all the ways that you have indicated. And I think most of the Members of the Congress, in passing this, had certain reservations that they thought would require such an analysis in order to continue. Hence, the sunset provisions.

I'm not in a position to evaluate all of your objections. I think this program could have fallen on its face, as I indicated earlier, if it were not for the very strong support from the President and the administration on it. I think the departments could have dragged their feet, they could have made it far less successful than it is.

I'd like to ask Mr. Shane if he'd care to comment on some of the points that Dr. Sherman has made from the standpoint of the overall value of the program; whether or not we wouldn't have been better off to use some other mechanism than the set aside to stimulate the development of small business research programs.

Mr. Shane. Our experience to date would show that the wisdom of Congress, in passing what they did pass, led us to establishing a new procurement program, a procurement program where we set in process solicitations with literally hundreds of brief technical topics within that solicitation, which you normally cannot do under the law.

You allowed us the freedom to establish a procurement program of 25-page proposal responses. I think we've seen the benefits of that. Literally 60 to 65 percent of the companies winning these awards are new companies who did not do business with the government before because of all the red tape and their perceived confusion.

I'm somewhat disheartened at times when people try to compare the SBIR Program with normal procurement, because you're dealing between a 25-page proposal and, in some cases—you saw my biography, I was with the Rockwell Corp. and I helped in the B-1 bomber proposal and that was 31 feet high. That was one copy. You cannot compare apples with oranges.

So, on looking at the particular position of the program at this time, I think it pays us to go back and look historically at what we set out to do. One was to increase the innovation concepts of the Federal R&D program, to have small business become more involved, and certainly, which everyone seems to be concerned with, to increase commercialization of Federal R&D.

Now, I have no reason to believe at this particular point that OSTP is going to fail to make some type of technical study. We look forward, as everyone else does, for the appointment of the replacement for Dr. Keyworth because I would like to sit down and discuss the matter with him.

Also, GAO's future report dealing with the agency's heads technical opinion, I think should be considered when you're dealing in terms of extension numbers. It's also a factor of what are we going to study and how far are we going to study. You can study technology for the worth of technology versus the worth of technology for some other premise.

I don't know if this is what we really set out to do. I think we have done critical technical evaluations—per the law. I have two scientists on my staff who continually go over all the topics and notify the various agencies of any errors.

I think we've seen a great growth in the whole process and, I think, a good refinement in the whole process. We started out with a brand new procurement system and brought it onboard and implemented it in 4 years, I think the Congress and the administration are extremely pleased with the progress to date.

I think everyone is correct in making an assessment at this particular time, the first phase II's have just graduated. I was just making a note to myself that by 1987 the second class will have graduated. We must move to do something or in 1988 we start phasing down the SBIR Program.

We will administer the program to fruition and follow the law. There is consternation in agencies with funding flow problems. I think an overall technical analysis can be made. I would suggest to Dr. Sherman that his requested analysis may be a little weighty, and overstated as to what the intent of the law was, but certainly in the long-term an analysis could be made.

From my experience in procurement over the last 30 years, I don't think an analysis as suggested by Dr. Sherman's has been made in any R&D program in the country.

Mr. BROWN. You have no quarrel with Dr. Sherman's point that we do need to conduct a fairly thorough analysis, including the points that he's made with regard to the fruits of this program, do you?

Mr. SHANE. I would——

Mr. BROWN. You're saying you're trying to make that analysis now.

Mr. SHANE. In answer to Dr. Sherman's approach, I would have to study it. I'm not sure what it all means. Many of the statements he made were rather generalized. I think once you start studying, one must become rather specific as to what to study.

Mr. BROWN. Is there anything unique or different about the biomedical research field that would cause a difference in the quality of the research proposals or a difference in the receptivity of the institutional structure in the biomedical field—the institutions represented by Dr. Sherman—to have a different view than in other agencies such as NASA or the Department of Energy, and so forth?

Mr. SHANE. We have no qualitative evidence of that. As a matter of fact, I think it should be pointed out that some of the awards being made are crossing over into several technical categories or fields, as an example biology and electronics being put together. I think the wave of the future in medicine will take in electronics in a very substantial way, and I think we're seeing a great part of this now.

Mr. Brown. My very generalized perception of NIH awards is that they focus on what you might call fundamental science, and less on the development of new technologies and innovative processes. I don't know that that's a fact. Maybe Dr. Sherman can comment on that.

Dr. Sherman. It's the primary thrust of the program, but there are numerous programs, and have been over the years, the last three to four decades, that had to do with the development of techniques or the development of diagnostic devices, including a heavy emphasis on bioengineering.

Mr. Ritter. Would the gentleman from California yield just for one question?

Mr. Brown. Certainly.

Mr. Ritter. Just following up on what Mr. Brown is saying, is it possible that the differences are due to the fact that the biomedical constituency for NIH is basically academic and nonprofit. And therefore, the goals of SBIR, which are to somehow arrange into this arena of commercialization a product and process, are not really goals that are felt in the academic community or even the hospital community.

Is that a possibility?

Mr. Shane. I would disagree with that premise. I find no difference at NSF, the National Science Foundation, where, as a matter of fact, the major participants and employees at the National Science Foundation came from academia and rotate back to academia.

Basic science and research is basic science and research.

Mr. Ritter. I understand. But I don't think your point is well-taken; and I'm trying to rationalize that as well.

But could it be that the consumers of NSF research as well is a broad cross section of commercial marketplace, and that the consumers of the academic and hospital research are still other hospitals or nonprofit institutions?

In other words, there are plenty of opportunities in the medical field to be commercial, but I mean in general could that be the difference that we're seeing here?

Dr. Sherman. I'd put it in a slightly different way, if I could, Mr. Ritter, without disagreeing with your general premise. And that is that in the health field you have a continuum from basic research to rather widespread application in the same environment. That is the academic medical center, which is quite in contrast to what you find in most other areas of our society and commerce.

This does not mean that there is not nor that there should be any lack of opportunity for interjection anywhere along that continuum of the type of activity that we're all agreed upon in this subject area should be pursued. But there is, I think, a significant difference in the environment where the health activities of research and development occur in general. This contrasted with the mission oriented programs of most other government agencies.

Mr. Ritter. Miss Eskesen? If the gentleman from California, who has so graciously yielded, would ask to continue to yield.

Mr. Brown. Certainly.

Ms. Eskesen. I'd like to add two points to what I think is the discussion here. First has to do with the place of employment of researchers. During the period of the fifties and sixties, with the significant increase in the academic and nonprofit community as an institutional form, anyone who was a graduate of a medical facility was likely to find employment in those academic and nonprofit organizations.

That has rather significantly changed not only in the medical field, but in a number of other fields, that the retraction in sheer size of the activities of the academic institution—as universities will tell you—that there are fewer numbers of students. But they are not expanding as they were in the sixties and seventies, and they are no longer able, in fact, to offer the facilities for those who are qualified to undertake research in fact to undertake that research.

I am a product of such an endeavor myself. For many years, an academic investigator there was no longer the opportunity because tenure tracked positions were already filled for me probably to remain for the duration of my research career in that environment.

I think what one classically has currently occurring is that transition from a place where you would normally find employment in the place that trains you to the recognition that there are other places which now employ those technically trained. And very often those other places are now the small business community.

I think it's an important point to note that was made by the NFIB presentation today, the biotechnology industry is made up predominantly of very small firms, primarily because it is a very new industry. And, in fact, as the mother of a budding biotechnician, I can tell you that that is perceived these days as the next generation, the next horizon, if you like, for scientific endeavor. The notion of commercialization in the biotech field is a relatively new one. But it is a very much emerging field so that it is almost as if while SBIR should not be the only instrument that is going to bring NIH to the conditions of the 1980's and nineties, in fact, the fact that SBIR is having that impact is consistent with what really is happening.

The circumstances of research and commercialization are changing in that field. And it is entirely consistent with that change that there should be some access by those who are part of that new group to the old sources of money. I forget who said it, but somebody once said no matter how long the duration of the argument, almost invariably you find disagreement in the first paragraph of the statements that are being made, and the definitions and assumptions from which the opposing argument is being presented are the ones with which you disagree. And I found in a lot of the testimony that was just presented by Dr. Sanders those types of problems.

The lack of similar definition. We have the same objectives, we expect to see some of the same results, and we have a lot of the same hopes, but we disagree in what are some of the means by which it will be achieved.

It's interesting to note, for example, that until 1982, January, specifically, of 1982, for a period of almost 20 years, those who were in the employ of the for-profit community in the medical research field were precluded from application to the National Institutes of Health. That is no longer the case, and the opportunity now exists for those in the for-profit community to make those types of application.

But it is a relatively recent phenomenon and it is part and parcel of this transition and change in the NIH condition, I think.

Dr. **Sherman**. May I add something there just to complete the record? Small business firms and all other for-profit organizations were eligible for NIH grant support until the late fifties or early sixties. At that time, as a consequence of a congressional investigation, the policy was changed and the restriction was placed.

It now is true, however, that those firms are eligible, have been eligible since 1982, and it's my understanding are competing really quite successfully in the regular program, to say nothing of the small business program.

Mr. **Brown**. Well, I'm glad to have this discussion. I was trying to explore the possibility that there was a different set of circumstances, maybe you might say a different culture, in the biomedical research field and some of the others. I'm not sure that this is the case, but I thought it was worth exploring.

I would also like to explore the possibility of the point that you made, Dr. Sherman, that there is really unlimited opportunity for excellent proposals from small businesses to be funded, and I suppose none of us would be disappointed if these excellent proposals, even without a set-aside program, were to exceed 1.25 percent.

In effect we seem to be moving toward this direction by upgrading the quality of participation in the small business community. Am I correct in this?

[Heads nod affirmatively.]

Mr. **Brown**. And we would assume that additional and better proposals will be forthcoming. And I know of no bar to prevent the agencies from exceeding the 1.25-percent amount if such proposals qualify for it.

Ms. **Eskesen**. I don't think there has been a track record of that amount being exceeded, but in a comparable condition there is considerable evidence that more companies are now engaging in the regular Federal procurement endeavor and not very much in NIH to date, but certainly in some of the other agencies. That the opportunity for communication between the technical offices and this new generation of competent small firms is creating those types of access which previously did not exist.

Dr. **Sherman**. I'm reminded also that a change in the patent policy, which the Congress enacted, had a great deal to do with that matter of eligibility and participation as well.

Mr. **Brown**. Dr. Sherman, the Congress has been making a very serious effort for at least the past 5 to 10 years to try and at least remove barriers to the development of innovation. We've acted in the patent field, we've acted in the antitrust field, we've acted in this field with noble motives, but we are aware that sometimes noble motives aren't enough.

We would hope to demonstrate through this program that small business does have the capability to do high quality competitive research, and that it will get its opportunity on the basis of excellence, and hopefully that we won't need this program at some point down the road. And that's the goal, I think your testimony helps to remind us of the importance of that goal and of measuring whether the program is achieving it effectively.

Thank you, Mr. Chairman.

Mr. Walgren. Thank you, Mr. Brown.

Mr. Ritter.

Mr. Ritter. Thank you, Mr. Chairman. Mr. Shane, is it true that initially when the pilot program for the SBIR was formulated it was at the National Science Foundation?

Mr. Shane. That's correct.

Mr. Ritter. And that to some extent it was opposed by the—basically the faculty/academic constituencies at the onset?

Mr. Shane. I think that was the case at the onset, yes.

Mr. Ritter. But now there seems to be a two-sided opinion coming from that constituency, doesn't there? You still have the old idea, but now because of the tremendous evolution of university/private sector cooperative efforts in technology advancement, you have some very different opinions coming out of the hierarchies of the universities; is that correct?

Mr. Shane. Yes. We have noted with considerable interest a change in university organization within the last several years. Many of the major universities——

Mr. Ritter. I think this is a really significant point.

Mr. Shane [continuing]. Are forming profitmaking businesses, and there has been a dramatic increase in that in the last several years.

Mr. Brown. Would the gentleman yield?

Mr. Ritter. Yes. I will.

Mr. Brown. I might point out also that one of the factors here—that in this committee for a number of years we have tried to make the point that we want a broader distribution of research capability. We have asked the NSF to encourage this. You might almost say that we have put pressure on the NSF over the years——

Mr. Ritter. As I recall, the gentleman was chairman of this subcommittee for a fair amount of time during which all of those things were taking place.

Mr. Brown. Some of the time I was, but I merely point to the fact that there may have been a difference in the NSF and the NIH because of the difference in the attitude expressed by the different committees having jurisdiction over it.

Mr. Ritter. I think that's a very interesting point. But I guess what's happened to the university constituencies is that they have entered into a whole set of new arrangements with local venture and regional venture capital with State governments sponsoring the advancement of technology with the whole idea of incubating small high technology businesses. I think it's a very positive step and probably is derived from the fact that the great well of gold at the Federal level was no longer overflowing and that new lines of economic opportunity were being sought by those university constituencies.

I guess contrasted to that is the—and as my colleague from California has pointed out—the difference in the committee's overseeing these processes; contrasted to that the medical community, the medical school operations have probably not developed these kinds of private sector, or at least not to the extent as the just normal university science and technology groups have developed, these kind of liaisons with the private sector.

Dr. **SHERMAN**. I think it's more a question of pace, Mr. Ritter. It certainly is occurring and at a more rapid pace, but certainly there hasn't been—and I think in part because of the unusual character of that environment—it hasn't been felt to be necessary in the past to the achievement of moving along, developing and moving along new knowledge in the mass application.

Now these new opportunities are opening up in medicine just as they have been, I think, previously in——

Mr. **RITTER**. I guess the point that one almost is led to arrive at is that unless there are the exigencies of the Federal budget process that coordination and cooperation and network building with the private sector doesn't necessarily occur, but that's just an observation.

I guess my last question is to Mr. Shane. What kind of breakdown of SBIR do we see right now in terms of how much of this $480 million is, say, being applied at NIH versus NSF, versus some of the other larger mission agencies? Where do we see this money going?

Mr. **SHANE**. How is the money being——

Mr. **RITTER**. In other words, to what fields does the money actually end up in?

Mr. **SHANE**. We have done computer analysis, which we do yearly, of all the awards. We take all the awards and break them into seven major fields, seven major technical fields, and break them according to phase I and phase II to try and track the amount of where the funds are being awarded.

We had broken them down to computer information analysis in phase I with 19.6 percent; electronics is 17 percent; materials research is 18 percent; mechanical performance of vehicles, weapons and facilities is 6.5 percent; energy conversion and use is 11.4 percent; environment and natural resources is 7.8 percent; and life sciences is 19.7 percent. These cumulative figures are for fiscal year 1983, 1984 and 1985.

I am working very closely with the agencies to make sure this blend does exist and we are pleased with the results to date.

Mr. **RITTER**. So the life sciences really is the largest share considering that NIH's research budget is the largest——

Mr. **SHANE**. Life science work is being done at the Department of Defense, National Science Foundation and NASA, so it is not just one specific agency. That premise would be an oversimplication.

Ms. **ESKESEN**. As a rough calculation, we did tally and the indications are that about 35 to 38 percent of the Federal dollars in the SBIR program are in the life sciences field because of the considerable overlap into DOD, into NASA, into the Department of Energy, and so on. It's a very, very substantial——

Mr. **RITTER**. What percent of SBIR is being funded by the NIH?

Dr. **SHERMAN**. About $50 million I think this year.

Mr. **RITTER**. So $50 million out of the $480?

Ms. **ESKESEN**. No, $305 million are—these are my figures. They're probably not quite official. But $305 million is the approximate fiscal year 1986 budget, and of that, approximately $40 million is from NIH specifically.

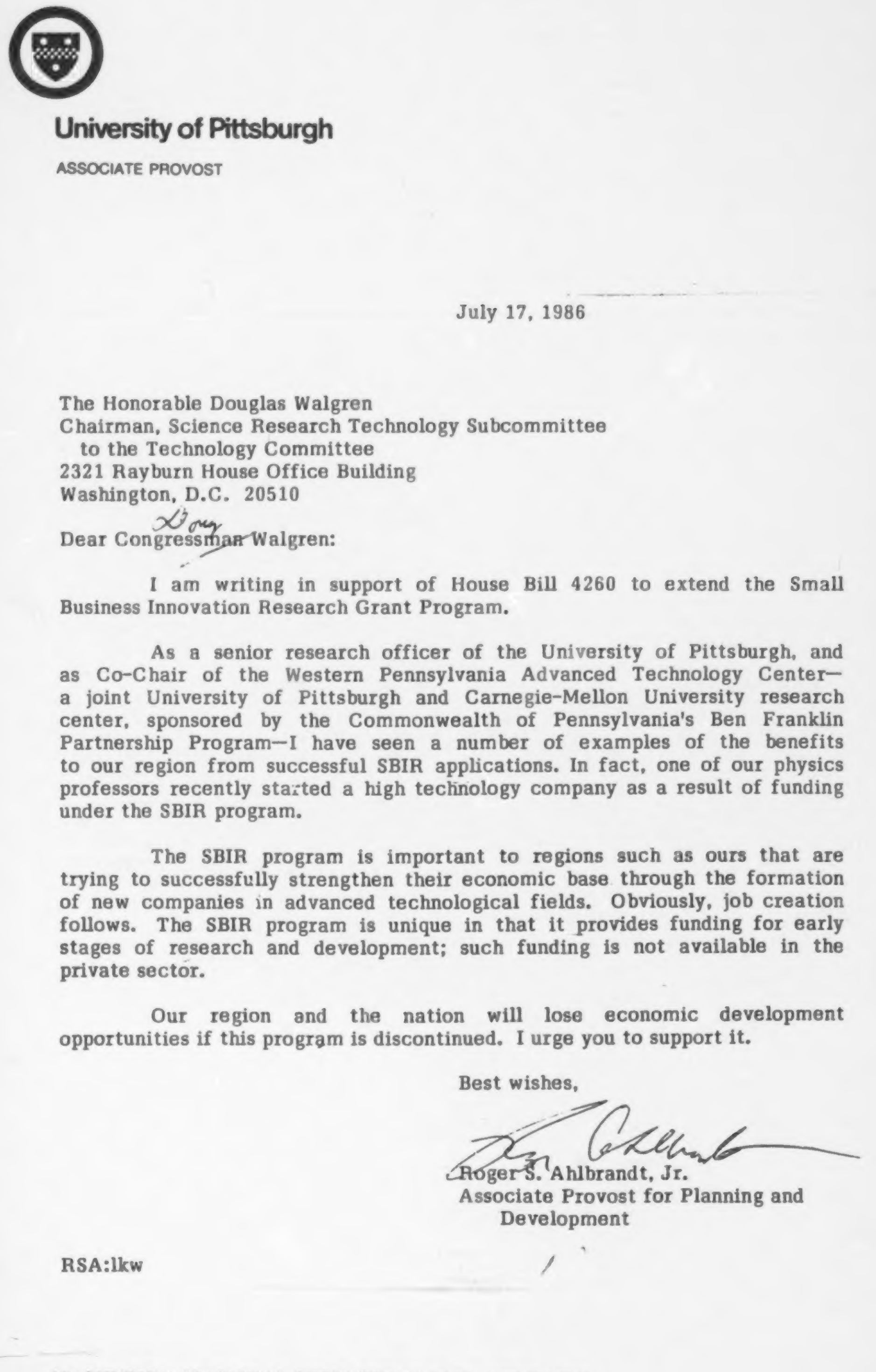
Mr. **Ritter**. I have no further questions and I thank the panel for their excellent testimony.

Mr. **Walgren**. Thank you, Mr. Ritter. We appreciate your interest in this and want to express our appreciation on behalf of the committee for all of you who have contributed testimony this morning.

Thank you very much.

[Whereupon, at 1:15 p.m., the subcommittee was adjourned.]

APPENDIX



University of Pittsburgh
ASSOCIATE PROVOST

July 17, 1986

The Honorable Douglas Walgren
Chairman, Science Research Technology Subcommittee
to the Technology Committee
2321 Rayburn House Office Building
Washington, D.C. 20510

Dear Congress~~man~~ Doug Walgren:

I am writing in support of House Bill 4260 to extend the Small Business Innovation Research Grant Program.

As a senior research officer of the University of Pittsburgh, and as Co-Chair of the Western Pennsylvania Advanced Technology Center—a joint University of Pittsburgh and Carnegie-Mellon University research center, sponsored by the Commonwealth of Pennsylvania's Ben Franklin Partnership Program—I have seen a number of examples of the benefits to our region from successful SBIR applications. In fact, one of our physics professors recently started a high technology company as a result of funding under the SBIR program.

The SBIR program is important to regions such as ours that are trying to successfully strengthen their economic base through the formation of new companies in advanced technological fields. Obviously, job creation follows. The SBIR program is unique in that it provides funding for early stages of research and development; such funding is not available in the private sector.

Our region and the nation will lose economic development opportunities if this program is discontinued. I urge you to support it.

Best wishes,

Roger S. Ahlbrandt, Jr.
Associate Provost for Planning and
Development

RSA:lkw

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July 17, 1986

The Honorable Douglas Walgren
Chairman, Science Research Technology
Subcommittee to the Technology Committee
2321 Rayburn House Office Building
Washington, D.C. 20510

Dear Doug:

I am writing in support of House Bill 4260 to extend the Small Business Innovation Research Grant Program.

As Provost of Carnegie Mellon University and as Co-Chair of the Western Pennsylvania Advanced Technology Center--a joint Carnegie Mellon University and University of Pittsburgh research center, sponsored by the Commonwealth of Pennsylvania's Ben Franklin Partnership Program--I have seen a number of examples of the benefits to our region from successful SBIR applications.

The SBIR program is important to regions such as ours that are trying to successfully strengthen their economic base through the formation of new companies in advanced technological fields. The SBIR program is unique in that it provides funding for early stages of research and development; such funding is not available in the private sector.

Our region and the nation will lose economic development opportunities if this program is discontinued. I urge you to support it.

Cordially,

Angel

Angel G. Jordan
Provost

NATIONAL COALITION TO REAUTHORIZE SBIR
Suite 305 • 2000 P Street, N.W. • Washington, DC 20036 • (202) 833-8845

TESTIMONY OF THE NATIONAL COALITION TO REAUTHORIZE SBIR

SUBMITTED TO SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

July 16, 1986

Mr. Chairman and Members of the Subcommittee:

I am pleased to submit the following testimony in support of H.R. 4260, a bill that would remove the sunset provision from the Small Business Innovation Research (SBIR) program.

The principal question that should be addressed in connection with the reauthorization of the SBIR program is whether the research and development projects that are supported by SBIR are of high quality. Hearings conducted by the House Small Business Committee's Subcommittee on General Oversight and the Economy addressed this question directly, and the response from the testifying agencies was uniformly positive. The following excerpts from that testimony are typical:

- EPA: "...we believe that this program has been a success."
- DoC: "...it is quite clear that the SBIR program has the potential of making a significant contribution to our R&D efforts."
- DoD: "It is our view that the current act is fundamentally sound, is working well, and should continue for the immediate future."
- DoE: "...the high technical quality of our SBIR gives us every reason to be optimistic about the program's eventual outcome...."
- DoT: "We are looking forward to the commercialization of some of the projects for which we have funded the initial stages."
- HHS: "...we are pleased to report that the Departmental SBIR Program has been quite successful.... The quality of SBIR applications has improved significantly as the numbers have continued to grow."

o NSF: "SBIR is working well.... [It] is funding cutting-edge research in key technology areas important to the economy...."

o NASA: "...we are greatly pleased with the high incidence of high-quality, thoughtfully-developed R&D proposals..., and fully expect that the end results and products will be quite valuable to our programs."

A second question concerns the eventual pay-off of the program. Experience has shown that the kind of technological innovation supported by SBIR takes many years to come to fruition. For most of the agencies, the first Phase II projects are just now ending, and hence it is premature to make assessments of commercialization efforts. Nonetheless, if the experiences of the agencies that joined the program in FY83 are similar to NSF, the pay-off in terms of investments of private capital, increased employment, and enhanced productivity will be substantial.

A third question concerns the necessity of legislation mandating the program. If the agencies think that SBIR is so good, why can't they run SBIR programs on their own? Two reasons are particularly salient: First, as some of the agencies testified in the Small Business Subcommittee, there are legal problems in conducting competitions that are limited to some particular group without specific legislative authority. Second, it is essential to understand the government-wide nature of the program. Without the legislation there would be no overall coordination of solicitation dates, no government-wide similarity of proposal requirements, no standard pre-solicitation notification procedures -- in short, none of the services that SBA's Office of Innovation, Research and Technology now provides. The functions of that office are a major part of the SBIR program; if each agency conducts its own program independently that overarching coordination will be lost and administrative costs would increase.

A fourth question relates to the role of universities in the SBIR program. It now appears that about one half of all SBIR projects involve people at academic institutions as consultants and in other ways -- a benefit both to the small business community and to the universities. Clearly SBIR is encouraging important links between university and small business researchers, thereby stimulating technology transfer that aids U.S. industrial competitiveness.

In summary, it is clear that the SBIR program produces R&D that meets current agency goals with the potential, in the long term, for enhancing U.S. productivity substantially. The SBIR program indeed deserves to be reauthorized.

AAU
NASULGC

July 15, 1986

The Honorable Doug Walgren
Chairman
Subcommittee on Science, Research
and Technology
Committee on Science and Technology
U.S. House of Representatives
2319 Rayburn House Office Building
Washington, DC 20515-6035

Dear Representative Walgren:

We write on behalf of the Association of American Universities (AAU) and the National Association of State Universities and Land-Grant Colleges (NASULGC), whose combined membership is comprised of the chief executive officers of over 150 public and private institutions engaged in federally sponsored research. The AAU and NASULGC appreciate this opportunity to make its views known to the Subcommittee on Science and Research on H.R. 4260, which would provide continuing authority for the Small Business Innovation Development Act of 1982.

The university community opposed the SBIR legislation in 1982 on the grounds that set asides of research funds for any purpose, no matter how worthy, undermine the process which the agencies have developed over the years to fund the best proposals presented to them, regardless of the source.

The Congress, however, found persuasive the argument that small business concerns needed a helping hand into the system and authorized a five-year experiment to encourage their participation. The university community respects that decision, and indeed, we have anecdotal evidence of small business and universities working together within the SBIR program to their mutual benefit. No hard evidence, however, seems to exist which would allow a determination about the success or failure of the program.

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July 15, 1986
Page Two

We do not oppose continuing this experiment for another term, but we do question the wisdom of making permanent the authority of the program when so little evidence exists. The measure of success, indeed, might be that the need for a set aside no longer exists.

Sincerely,

Robert M. Rosenzweig

Robert M. Rosenzweig
President
Association of American
Universities

Robert L. Clodius

Robert L. Clodius
President
National Association of State
Universities and Land-Grant
Colleges

aamc association of american medical colleges

September 4, 1986

Honorable Doug Walgren
2241 Rayburn House Office Building
U. S. House of Representatives
Washington, D.C. 20515

Dear Mr. Walgren:

A reading of the transcript of the Hearing of July 16th on H.R. 4260 evoked two responses from me and the AAMC (Association of American Medical Colleges) staff that might interest you: the discussion on that occasion between you, Representatives Brown and Ritter and the witnessess came to grips with the substance of issues with far greater precision and penetration than is usual in Congressional hearings; and I missed a couple of opportunities to contribute germane information. This letter is intended to rectify the latter situation.

One recurrent theme in the discussion related to apparent differences in attitudes toward SBIR between one group---the NSF, the NASA, the DOE; the university performers of research supported by these agencies; and the national voices for the latter institutions such as the AAU and the NASULGC---and another---the NIH, the medical schools and the AAMC. Speculation about the basis for the perceived discordance related to differences between the two groups with respect to: the intensity with which they were engaged in basic versus applied research; the prevalence of a commerce-oriented attitude; the degree of proximity to and interaction with business and industry; and the extent to which research scientists were also consumers of innovations.

On careful reflection, I don't think that medical schools and teaching hospitals are, in any critical respect, dissimilar when measured against these criteria. True, the NIH supports, and scientists in academic medical centers perform, a great deal of basic research. But as I mentioned, the environment in which much medical research is undertaken is unusually singular, namely, the academic medical center, with a resultant and highly productive mixture of and interplay between basic and applied research. The presence of sick people in the research environment constantly highlights the need, and creates pressure, for clinical application. And, as in every field of science, the requirement to measure physical and chemical phenomena with quantitative precision, stimulates the development of new methods and techniques for measurement: reagents, instruments, devices, etc. Development is characteristically a process that arises in many organizational and institutional settings, involves multidisciplinary collaboration within academic institutions and between academe and industry, and eventuates first in prototypes and then in marketable products. The markets range from small to large: small for those that are relevant, say, to only a single pre-clinical discipline; large for those that eventually end up in every physician's office or every patient's medicine cabinet. Many, if not the majority, of recent products have been developed and marketed by small to intermediate size businesses. Let me mention some examples.

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Biochemical entitities of a wide variety have been in great demand, sometimes in reagent quantitites: thus, a modest sized industry supplying "rare" biochemicals has emerged over the last several decades. Radionuclides are extensively used in biomedical and behavioral research; the need for an ever expanding variety of radioactively labeled compounds continues. Antigen-antibody reactions provide a basis for very sensitive measuring techniques; the call for antibodies, often in reagent amounts, with or without fluorescing compounds attached, is growing. The creation of monoclonal cell lines to produce large amounts of antibodies is already in commerce.

Instrument development has proceeded apace. A broad spectrum of sensors, transducers, signal analysers and recorders is now available for use in laboratory and clinic, in the doctor's office, at the bedside, in the intensive care unit (ICU) and in the operating room. Microscopy continues to develop in the form of phase contrast, fluorescence and electron microscopes of several types. Biochemistry, molecular biology and cytogenetics laboratories now use a broad array of radionuclide measuring devices, sequencers for amino and nucleic acids, (computerized) mass spectrometers, various instrumental ensembles for chromatography and electrophoresis, to mention just a few of the larger and more expensive instruments that have come into common use.

In clinical pathology laboratories, automated instruments to count cells---e.g. red blood cells---and to measure important physiological chemical entitites in biological fluids---e.g., plasma concentrations of glucose, cholesterol, bilirubin, uric acid, creatinine---have all facilitated and expedited laboratory diagnosis. In the clinics, many new techniques have recently emerged for evaluating and monitoring various physiological and pathophysiological variables. Diagnostic imaging has been expanded to include several different types of scanners: CAT (computerized axial tomography) MRI (magnetic resonance imaging) and PET (positron emission tomography), not to mention a host of scintillographic scanning techniques that now provide both static and dynamic data on the function of many organs---heart, kidney, liver, biliary system, urinary system, thyroid, etc. The electrical activity of the hearts of patients can now be, and frequently is, continuously monitored, even telemonitored in real time.

Fiberoptic endoscopes now make visually accessible hitherto invisible regions of the body---the interior of the entire large bowel, stomach, duodenum; the urinary bladder; the interior of many joints, etc.---and facilitate biopsy and other surgical procedures that formerly required major operative interventions.

Drug and device development has long been an area of collaboration between academe and industry. Ideas and concepts for new chemotherapeutic research are stimulated by advances in basic understanding of biological phenomena, usually an academic contribution. The intermediary stages are collaborative, and have been expedited greatly by the strength of the pharmaceutical industry in chemical synthesis. The final testing of compounds in controlled clinical trials is often conducted in academic centers. The last several decades have witnessed the introduction of literally hundreds of powerful and effective new therapeutic agents. Devices are becoming increasingly important and prevalent. Insertion of prosthetic heart valves, joints (hip and knee), or even penises are a commonplace occurrence in large medical centers. Catheters of many types and varieties are frequently used for obtaining samples, injecting contrast materials, making measurements, administering therapeutic agents or performing therapeutic procedures in many otherwise inaccessible sites---pulmonary artery, coronary artery, adrenal vein, common bile duct, just to mention a few.

Finally, good patient care techniques have stimulated the development of many extensively used products: paperware, e.g., absorptive pads, face masks; plastic ware, e.g., disposal syringes, food service containers, basins, containers for blood, tubing for intravenous lines; drop-counters for regulating administration of parenteral therapeutic agents; etc.

What I have cited are a few examples from the weighty catalog of products now in commerce that have their origins in, or for, biomedical research of the genre supported by the NIH and conducted in academic medical centers. Some of these products have limited markets and are useful mostly in the research laboratory; others are of more general utility and are consumed in large quantities. In the aggregate, these innovative products represent a very substantial amount of mercantile activity. Their production, moreover, is by no manner of means dominated by industrial giants. The biotechnology industry is a contemporary case in point; the leading firms at the moment are quintessential small business entrepreneurs. Biomedical research as an enterprise is well aware of the importance of industrial innovation; in fact, that community is, and has been, heavily dependent upon the business/industrial sector for the development of the reagents, instruments, devices, and techniques that will accelerate the exploitation of new knowledge and enable fields of science to continue to advance. Moreover, the practicing medical community is and has always been very receptive to adopting innovations that enhance the ability of practitioners to take better care of sick people. The AAMC's constituents don't have any serious reservations at all about the desirability of innovation. But they just don't believe that the set-aside mechanism prescribed in the legislation for the SBIR program is a sound way to achieve a public good in this arena. I have serious doubts that the views of thoughtful people in other scientific and technical arenas are really any different from those prevailing in biomedicine.

Another theme that surfaced in the hearing related to the history of the access of businesses (small and large) to funds from the NIH. The latter agency has been pilloried for refusing to accept research grant applications from business concerns over a long period of time and for allowing these firms access only after intense and continued pressure from the Congress, as a result---in part at least---of agitation by the small business community.

This criticism may have scored a few debating points for its proponents; but on close examination, their case isn't very convincing to me. The decision by the NIH in the 1960's to make for-profit firms ineligible to apply for grants caused nary a ripple, for the simple reason that for-profits constituted a miniscule fraction of applicants or grantees. Until the policy was reversed in FY 1982, the pressures for change, I am told, emanated almost exclusively from political, not from potential grantee organizations. Subsequent developments bear this out. The number of competing regular---not SBIR---research project applications received by the NIH in FYs '83, '84 and '85 from small business firms were, respectively, 35, 38 and 44 (out of totals of about 16,000 - 18,000); the comparable numbers from large businesses were 6, 8 and 12. The NIH, in opening up its grant program to the for-profit sector, has thrown a party which virtually no one has attended.

Surprise? No. The NSF has never denied the for-proft section access. Yet in FYs '77, '78, '79 and '80, the number of "actions" involving the for-profit sector was inconsequential in the life sciences---12, 9, 13 and 8 applications, respectively, out of a total of about 5500; the intensity increased to 36 out of 5160 in 1981. Over the same period, FYs '77-81, "actions" involving for-profits in the non-life science components of the NSF were, for reasons I have never explored, much larger in relative terms but still small; they comprised, seriatim, 2.3, 5.0, 6.0, 6.6 and 7.8 percent of a total of 10,000 - 12,000 applications (Enclosure I).

I think that one has to conclude that the regular research grant programs of the federal government are not now and never were very attractive to the for-profit sector. The modifications of patent law in 1980, that allowed academic institutions and small businesses to retain patent rights on inventions emerging out of federally funded research activities, might account for the increases in FY 1981 applicants to the NSF programs. Why the small business community so heavily oversubscribes an NIH set-aside program---598, 695, 774 and 1477 applications, respectively from FYs 1983 - 1986 (to date)---yet participates hardly at all in the regular research grant program is unclear to me. The success rates of recent applicants belies any claim of discrimination.

I hope that this material is helpful. The AAMC was generally pleased with the version of H.R. 4260 that passed the House and is hopeful that the Senate will adopt it without change. The Science and Technology Committee's amendment significantly improved the bill and for this, the Association applauds you.

Sincerely yours,

John Sherman

John F. Sherman, Ph.D.
Vice President

Enclosure

cc: George E. Brown, Jr.
Don Ritter

Enclosure I

AWARDS TO PROFIT AND NON PROFIT APPLICANTS IN NSF FY's 1977-81

Life Sciences

		Actions	% of all Actions	Awards	$(1,000)	%$ Awarded	Success Ratio
1977	Profit	12	0.25%	5	282	0.3%	42%
	Non-Profit	4814		2035	97,232	99.7%	42%
1978	Profit	9	0.16%	3	210	0.2%	33%
	Non-Profit	5551		2123	104,075	99.8%	38%
1979	Profit	13	0.22%	3	235	0.2%	23%
	Non-Profit	5843		2281	116,135	99.8%	39%
1980	Profit	8	0.14%	3	254	0.2%	37%
	Non-Profit	5535		2369	127,575	99.8%	43%
1981	Profit	36	0.63%	12	992	0.7%	33%
	Non-Profit	5760		2484	141,918	99.3%	43%

All Others

		Actions	% of all Actions	Awards	$(1,000)	%$ Awarded	Success Ratio
1977	Profit	238	2.3%	124	11,735	2.9%	52%
	Non-Profit	10,244		5745	393,064	97.1%	56%
1978	Profit	542	5.0%	133	11,230	2.5%	25%
	Non-Profit	10,740		6020	430,713	97.5%	56%
1979	Profit	694	6.03%	154	19,125	4.0%	22%
	Non-Profit	11,505		6362	458,277	96.0%	55%
1980	Profit	769	6.6%	149	15,422	3.0%	19%
	Non-Profit	11,724		6433	490,312	97.0%	55%
1981	Profit	948	7.3%	175	26,249	4.8%	18%
	Non-Profit	12,098		6518	524,162	95.2%	54%

Definitions, Inclusions, and Exclusions

Life sciences is defined as all actions taken and awards made in the divisions of Environmental Biology, Physiology, Cellular, and Molecular Biology, and Behavioral and Neural Sciences in the Biological, Behavioral, and Social Sciences Directorate.

Actions are defined as awards, declines, or withdrawals.

Awards include only grants and contracts to support research projects.

Excluded from the category of awards are: fellowships, procurement contracts (to purchase desks, chairs, paper, paper clips, computer time and the like), dissertation research projects, support for conferences, equipment (when not part of a research project), and international travel; that is, all awards, grants, or contracts which did not support research projects.

Source: National Science Foundation